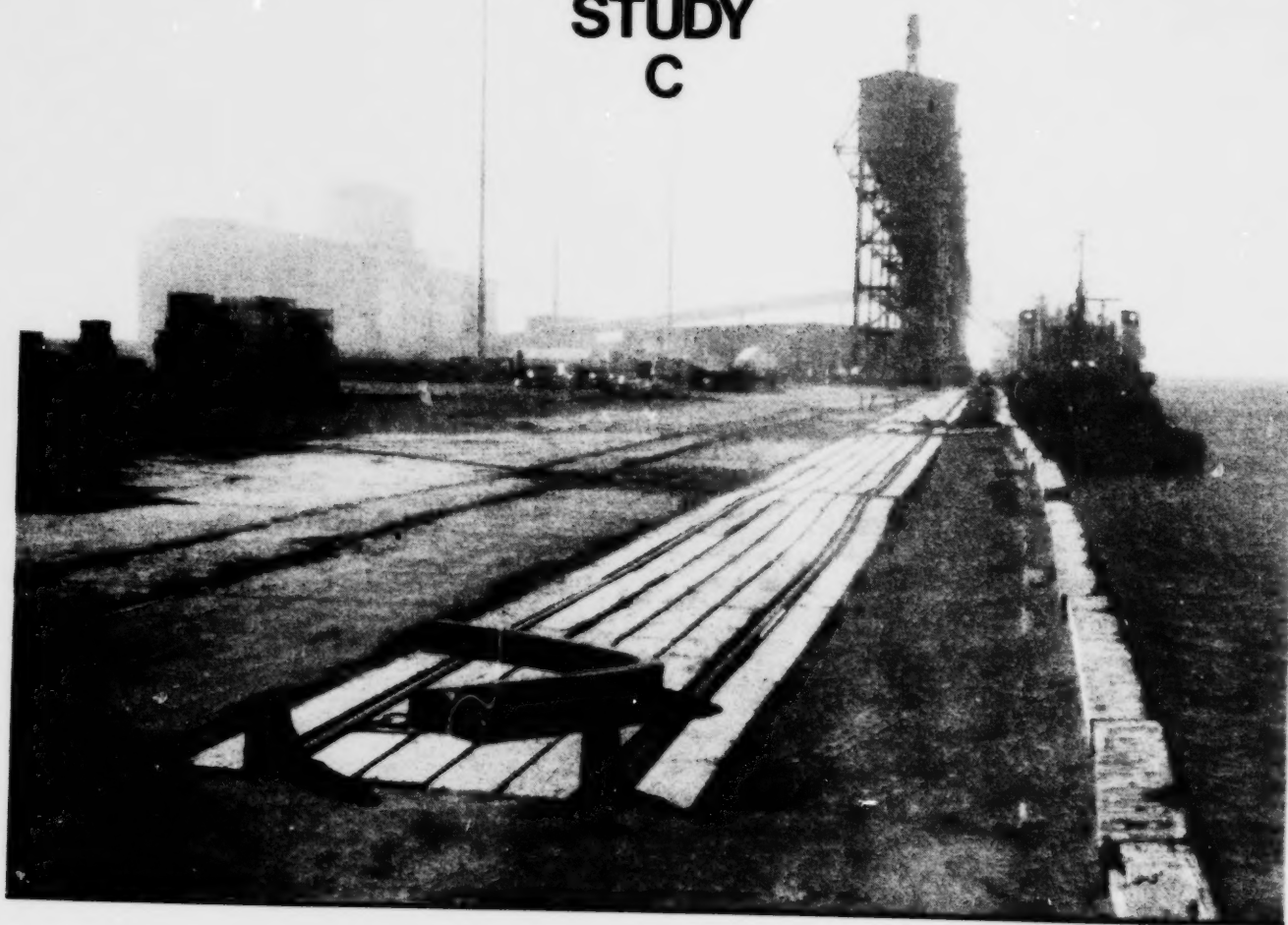


GOVERNMENT OF CANADA
Transport Canada

GOVERNMENT OF MANITOBA
Highways and Transportation

PORT OF CHURCHILL RESUPPLY OPERATIONS

STUDY C



MARCH 1986

IBI
GROUP

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PORT OF CHURCHILL

RESUPPLY OPERATIONS STUDY

STUDY C

Prepared for

GOVERNMENT OF CANADA

TRANSPORT CANADA

GOVERNMENT OF MANITOBA

HIGHWAYS AND TRANSPORTATION

by

IBI GROUP

in association with

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Captain Harold Cooper

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March, 1986



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Gentlemen:

PORT OF CHURCHILL RESUPPLY OPERATIONS
STUDY C

We respectfully submit the above report presenting our findings on options to preserve and expand rail, marine and air Arctic resupply operations at Churchill. In accordance with the contract for this work, dated July 25, 1985, this report addresses one of the four studies comprising the overall Churchill study, as follows:

- A. Season Extension;
- B. Additional Commodities;
- C. Resupply Operations;
- D. Grain Shipping Costs.

The above four studies were all carried out by IBI Group and its associated sub-consultants, on an integrated basis; the accompanying report addresses the results of Study C only. The overall findings and results of Study C are summarized in an Executive Summary at the beginning of the report. The Summary follows the same structure as the main body of the report which, of course, presents the study findings and results in substantially greater detail.

We wish to acknowledge with thanks the advice and direction of the Steering Committee for this study under your co-chairmanship and the cooperation of the many people who provided information and opinions related to the study. The consultant team bears responsibility for our findings, conclusions and recommendations, as presented herein.

March 27, 1986

Page 2

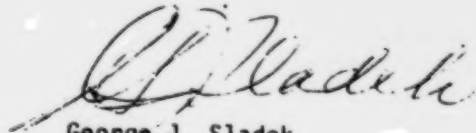
We hope that the economic comparisons presented in this report will assist the Government of Canada, the Government of Manitoba and other interested parties in reaching the most appropriate policy position regarding the Port of Churchill, in the long term interests of the country.

Yours sincerely,

IBI GROUP



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Encl.

The contents of this report reflect the opinions of the Consultant and are not to be construed as the official policy of Transport Canada or Manitoba Highways and Transportation.

Dimensions and measurements contained in this report may appear in both imperial and metric units as a reflection of common usage and standard practice of the transportation industry.

ACKNOWLEDGEMENT OF PARTICIPATION

The Resupply Operations Study was conducted on behalf of the Government of Canada (Transport Canada) and the Government of Manitoba (Highways and Transportation) under the Canada-Manitoba Subsidiary Agreement on Churchill.

Consultant support to the IBI Group, the main consultants, was provided by the following firms:

- o Stevenson Hluchan & Associates - Consulting Engineers (Marine and Harbour Facilities);
- o Canadian Offshore Data Analysis (Atmospheric and Icing Conditions);
- o Captain Harold Cooper - (Towing and Navigation);
- o Captain E. Pelletier (retired) - (Coast Guard and Ice Breaker Operations);
- o J. Steve Merrett Consulting Services (Economic Analysis).

A multi-disciplinary steering committee composed of representatives from Transport Canada and the Manitoba Department of Highways and Transportation provided overall direction and facilitated information exchange with relevant organizations and individuals. The governments of the Province of Alberta and the Province of Saskatchewan also provided senior support to the steering committee and the Study.

The contribution of all participants is gratefully acknowledged. Responsibility for the findings and conclusions presented herein rests with the consultants.

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PORT OF CHURCHILL RESUPPLY OPERATIONS

STUDY C

EXECUTIVE SUMMARY

1. STUDY OBJECTIVE AND SCOPE

This study was conducted on behalf of the Government of Canada, Transport Canada, and the Government of Manitoba, Department of Highways and Transportation, under the Canada-Manitoba Subsidiary Agreement on Churchill. It is part of an overall study of the Port of Churchill conducted on an integrated basis by IBI Group and its associated consultants, with the following components:

- o Study A: Season Extension;
- o Study B: Additional Commodities;
- o Study C: Resupply Operations;
- o Study D: Grain Shipping Costs.

This Executive Summary provides a brief overview of the objective, scope, major findings and conclusions of Study C.

Objective

As stated in the Terms of Reference, the study objective is:

"to evaluate options to preserve and expand rail, marine and air resupply operations at Churchill."

Study Scope

The study is to examine three principal questions which relate to the long term preservation and expansion of Churchill's resupply role:

1. How might the operational efficiency of resupply activity at Churchill be improved?
2. Are there any economically viable options for increasing the ex-Churchill share of northern resupply traffic?
3. Would extension of the operating season of the Port open any opportunities for improving and/or expanding the tug and barge resupply operation?

In addressing these questions, the study is to analyze current operations, develop forecasts of commodity movements to the year 2000, identify technically feasible options for handling the future traffic efficiently and improving the level of service, and conduct an economic assessment of the options. The study is to evaluate prospects for increasing the share of north-bound traffic which is handled through Churchill and assess the impact of such additional traffic on the performance of the resupply activities at Churchill. A strategy is to be proposed for improving and expanding Churchill's role in air and marine resupply operations.

The sections of this Executive Summary mirror the structure of the main report.

2. PRESENT SERVICES AND PROJECTIONS

Chapter 2 of the report describes the existing and potential resupply area, its population and its present marine, rail/road and air resupply services. It presents information on the amount of cargo delivered by each of the major services into the region, presents projections of population to the year 2004 and makes tonnage projections based on these.

The study area is defined as the Keewatin region of the Northwest Territories plus, in terms of marine resupply, an area extending north into Foxe Basin, northeast to the easterly entrance of Hudson Strait, east

to the coastal communities bordering on the eastern side of Hudson Bay and James Bay, and south to the Ontario coast line of Hudson Bay. In terms of air resupply, the study area includes the Keewatin, the eastern communities of Kitikmeot and much of Baffin Island. (See Exhibit 1.1 in the report).

There are approximately 20,000 persons living in the combined study areas, of whom about 17,000 are in the area considered potential to marine resupply wholly or partly from Churchill and about 10,000 are in the area considered potential for air resupply.

Existing Marine Services

There are three major sources of marine shipments into the Arctic communities: the Mackenzie River system, the Port of Churchill, and the Port of Montreal. The routes generally followed by marine services are shown in Exhibit 2.1 of the report and the road and rail access routes to the Port of Churchill are shown in Exhibit 2.4. In addition, the Port of Moosonee in James Bay offers ferry services in James Bay and to adjacent coastal communities. Appendix A of the report describes marine resupply facilities at the Port of Churchill.

Six ports in the Keewatin are served from Churchill by Northern Transportation Company Ltd.* (NTCL): Eskimo Point, Whale Cove, Rankin Inlet, Chesterfield Inlet, Baker Lake and Coral Harbour (see Appendix B). NTCL provides this service with one tug and four barges. In normal operation, the tug takes two barges to a community, unloads the fuel and then beaches the barges to permit them to be off-loaded by crews flown in from Churchill. When off-loaded, the goods are taken to the customer's warehouse or specified locations. The tug then returns to Churchill with two empty barges and picks up two loaded barges for a trip to another community.

* In late 1985 NTCL was sold by the Government of Canada to the Nunasi Corp.

The Baffin Island communities are principally served by the Eastern Arctic Sealift operating out of Montreal. The Canadian Coast Guard coordinates this operation. Tenders are called separately for fuel deliveries by tankers and for dry cargo deliveries by Canadian merchant vessels. The Eastern Arctic Sealift vessels deliver dry cargoes to the high water mark and it is the responsibility of the consignee to transfer goods from there to his receiving location.

The Quebec communities on the eastern shore of Hudson Bay are served with dry cargo from Montreal by a Quebec Government Sealift, and by the federal government Eastern Arctic Sealift referred to above; fuel service is provided by Shell Oil Limited. Moosonee Transportation Co. Ltd., offers service primarily to James Bay and adjacent communities. The two Sealifts are supplied by Canadian vessels which bid on contracts tendered for the transport of dry cargo by the Quebec and federal governments respectively.

There are two communities on the Ontario coast of Hudson Bay, Fort Severn and Winisk. The former is currently served by Moosonee Transportation Co. Ltd. and the latter is expected to be served in future by the same company following completion of harbour facility improvements.

Rail and Road Services

Churchill is served by the Hudson Bay Railway, operated by CN Rail. Dry cargo destined for the Keewatin area and shipped by rail originates primarily in Winnipeg and secondarily in Edmonton. Bulk fuel for the Keewatin is supplied from Churchill from storage tanks which are leased to Esso Canada Limited on a five year contract starting in 1984. Fuel is brought by rail to Churchill from points in Saskatchewan served by pipeline.

The major part of the dry cargo shipments through Churchill are handled by or on behalf of three organizations: The Hudson's Bay Company, Arctic Cooperatives Limited and a number of agencies of the Government of

the Northwest Territories. These organizations in turn use the services of three transportation or forwarding organizations: Costa Cartage, Federated Cooperatives, and CN Route Trucking.

The majority of the shipments are consolidated in Winnipeg, normally palletized and shipped north in one of three ways:

- o in full boxcar loads, directly from Winnipeg;
- o in highway trailers on flatcars by rail directly from Winnipeg; or
- o in highway trailers by road to Thompson for transshipment by special piggyback cars to Churchill.

The Port of Moosonee on James Bay is supplied by the Ontario Northland Railway (ONR). Goods for Moosonee are normally shipped by CN Rail or truck from Southern Ontario to Cochrane and then via the ONR to the port

Air Services

Unit toll and charter air resupply services in the study area are provided by seven firms, with head offices as follows:

- | | |
|----------------------------------|-------------|
| o Keewatin Air | Winnipeg |
| o Nordair | Montreal |
| o First Air | Ottawa |
| o Pacific Western | Calgary |
| o Northwest Territorial Airlines | Yellowknife |
| o Calm Air | Thompson |
| o Kenn Borek Air | Resolute. |

In addition, there are charter operators with licenses to operate at specific airports in the study area:

- o Bradley Air Services;
- o Nunasi Central Airlines;
- o Austin Airways.

The routes served by each of the scheduled carriers are shown in Exhibit 2.6 of the report, with further information on air carriers and airports presented in Appendix D.

In addition to their requirements as Arctic communities, the towns of Frobisher, Hall Beach, Cambridge Bay and Resolute have an additional role as points on the DEW Line. Resolute also has a special role, with a military installation and as a destination for organized tourist parties coming in by air.

Marine Resupply Cargoes

The annual tonnage delivered by NTCL to the six communities in Northwestern Hudson Bay has varied between 15,700 and 24,500 tonnes in the eight years, 1978 to 1985, with an average of 21,000 tonnes. Bulk fuels have accounted for between 70 percent and 80 percent of these cargoes, with an average of 73 percent. On average, some 1.3 tonnes per capita of dry cargo and some 3.1 tonnes per capita of bulk fuels are delivered by NTCL; lower amounts per capita to the southern three communities reflect a higher market share by the air resupply mode.

The total tonnage delivered by the Eastern Arctic Sealift in 1984 was approximately 48,000 tonnes, divided into 36,000 tonnes of bulk fuel (75 percent) and 12,000 tonnes of dry cargo. The deliveries of bulk fuel were in the range 4 to 4.5 tonnes per capita and of dry cargo 0.8 to 1.5 tonnes per capita.

Churchill Railway Traffic

CN provides one freight train per week which leaves Winnipeg on Saturdays and arrives in Churchill on Mondays. In addition, a restricted piggyback service is provided three times per week out of Thompson on specially equipped cars attached to the VIA passenger train. The movement of freight (exclusive of grain) while fluctuating significantly from year to year, has exhibited a flat trend during the past decade, averaging

close to 40,000 tonnes per year. In recent years it fell from a peak of 56,000 tonnes in 1980 to 30,000 tonnes in 1982, recovering to 56,000 tonnes in 1984. Throughout the period 1975-1984, bulk petroleum product shipments averaged 28,000 tonnes per year, ranging from a low of 15,000 tonnes in 1978 to a high of 44,000 tonnes in 1984. The shipments of both dry goods and bulk fluids represent requirements both for the local Churchill market and for Arctic resupply.

Air Resupply

As shown in Exhibit 2.12 of the report, the air mode's share of resupply traffic was estimated at about 48 percent of the total dry cargo in 1979 and 1980, rising to about 66 percent in 1982 and 1983 and falling again to about 38 percent in 1984 and 55 percent in 1985, based on government policy initiatives in 1984 to increase marine shipments. The total demand for dry cargo in the Keewatin by marine and air services combined is approximately 3 tonnes per capita.

Traffic Projections

Based on past trends and future expectations regarding natural increase and immigration, the base line forecast of population represents a growth rate of about 2.7 percent per annum over the 1984-1989 period and about 2.3 percent per annum over the 20 year period 1984-2004 in the study area. Using the values of 3.9 to 4.5 tonnes per capita for bulk fuel and 3 tonnes per capita for the dry cargo (with a 50/50 marine/air modal split) the total resupply cargo demand in the Keewatin area is estimated at about 27,000 tonnes by 1989 and about 30,500 tonnes by 1994, about 25 percent above the 1984 level.

If the NTCL territory were expanded to include Foxe Basin, Hudson Strait and/or the east side of Hudson Bay, the total estimated tonnages in 1989 and 2004 would be:

	<u>1989</u>	<u>2004</u>
Keewatin plus Foxe Basin	36,800	41,800
Keewatin plus Hudson Strait	34,000	38,600
Keewatin plus the east side	77,600	88,000

3. MARINE AND RAIL RESUPPLY

Chapter 3 of the report describes the component costs of transportation of goods from origin to destination on a comparable basis and presents an evaluation of opportunities to route more marine traffic through Churchill, either by extending NTCL services or by making it attractive for vessels presently operating from Montreal to use Churchill for some of their deliveries. The chapter concludes with a summary of opportunities which appear to offer the possibility of cost-effective marine routings through Churchill for shippers under certain conditions. A lower cost road/rail link from Winnipeg to Churchill is a key component in inducing additional traffic and it is discussed. The opportunities are evaluated in more detail in Chapter 5.

Transportation Rates

Marine transportation rates quoted by NTCL or by the Eastern Arctic Sealift differ in three different respects:

- o NTCL charges firm rates negotiated year-by-year with Transport Canada while Sealift rates are tendered each year and are more variable and unpredictable;
- o NTCL charges for dry cargo primarily by weight but the Sealift charges by a combination of weight and volume measurement; and
- o NTCL delivers dry goods to the consignee's location whereas the Sealift delivers to the high water mark.

NTCL marine rates are \$116 per tonne for bulk fuel, \$399 per tonne for dry cargo and \$187 per tonne for 75 percent bulk and 25 percent dry cargo. The Eastern Arctic Sealift rates range between \$80 per tonne

and \$116 per tonne for bulk fuel, between \$381 and \$587 per tonne for dry cargo, and \$155-\$229 per tonne for 75 percent bulk fuel plus 25 percent dry cargo. NTCL rates would be about \$24 per tonne less than Sealift rates to the Foxe Basin but are about \$32 per tonne more than the Sealift rates to Hudson Strait.

It should be noted that the rates do not fully repay costs in either service. NTCL receives a subsidy which varies from year-to-year and in the period 1978-1982 averaged about 20 percent of revenues. The Sealift is not formally subsidized but the consignees pay only the direct shipping cost with no allowance for the administration costs of the Canadian Coast Guard; this could amount to 10 percent-20 percent of system costs.

The rail rate from Winnipeg to Churchill for general merchandise is \$123 per tonne (\$5.60 per 100 lbs.), if shipped in a boxcar with an 18.5 tonne (40,000 lbs.) minimum weight. The cost for less than carload quantities is \$212 per tonne (\$9.60 per 100 lbs.). There is a proposal to consolidate shipments in Winnipeg (by resupply port destination), take the containers by truck to Thompson, Manitoba and then by rail flatcar to Churchill, where they would be loaded directly onto the NTCL barge. The proposed charge would be \$123 per tonne (\$5.60 per 100 lbs.) for this service, which is presently in the discussion stage.

Dry cargo shipments from Toronto to Moosonee move at \$132.70 per tonne in 40,000 lb. carload quantities.

Bulk fuel is shipped part way (e.g. to Regina) by pipeline and then by rail to Churchill at an estimated charge for the rail segment of about \$82 per tonne. The cost to ship crude oil from Edmonton to Montreal by pipeline, however, is only \$3 per tonne. Montreal therefore starts with a differential advantage of about \$79 per tonne in comparison with Churchill. Because of some absorption of transport costs by the oil company, this difference, in practice, is about \$68 per tonne. Since NTCL charges \$116 per tonne for bulk fuel delivery from Churchill to the Keewatin ports, a customer would be able to obtain his fuel more cheaply

from Montreal provided the Sealift cost were less than \$184 per tonne. As noted earlier, however, Sealift costs are everywhere less than \$116 per tonne. This leads to the conclusion that Churchill is uncompetitive with Montreal as a source for Arctic resupply of bulk fuels unless Churchill can obtain fuel stocks by ocean tanker (as discussed in a later section).

Expansion of NTCL Services

Section 3.2 of the report examines the operational feasibility of expanding the NTCL resupply services into, respectively, Foxe Basin, Eastern Hudson Strait, the east side of Hudson Bay, and the Ontario coast south of Churchill. It is concluded that expanding NTCL's service into Foxe Basin would require lengthening its shipping season at Churchill to November 13 using present operational methods and to October 23 through streamlined loading/unloading operations with containers. The normal NTCL season is 81 days, from July 17 to October 4, although the firm is prepared to operate until October 15 if cargoes are available, so the required season extension would be a further eight days. If the service were expanded to include Eastern Hudson Strait (not including Foxe Basin) the season at Churchill would have to be extended to October 30 using present methods or to October 10 using streamlined methods. If an attempt were made to serve the Keewatin together with both Foxe Basin and Hudson Strait, then even with reduced loading and unloading time the season would be 40 days longer than at present, implying a normal season completion on November 13.

If Sanikiluaq (on the Belcher Islands in Southeast Hudson Bay) were added by itself, the operation could be included within NTCL's present planned season closure of October 15. If Foxe Basin, Hudson Strait and Sanikiluaq were all added with no change in practice, the required season length would be 163 days (compared to the present NTCL season of 81 days) which would be impractical. This could be reduced by buying an additional tug and the associated barges, but the cost of this would be prohibitive in comparison with Montreal-based service unless the equipment could be used effectively elsewhere during the Churchill off

season. NTCL's existing tug has to restrict its territory to appropriate waters since, if the vessel were locked in ice for any significant period of time or if it were damaged, it would jeopardize the supply of materials to the basic Keewatin ports. For this reason, it is considered by the NTCL and the study team that Foxe Basin is not a suitable destination to be served by NTCL unless suitable additional marine equipment were to be provided.

The price of oil in Churchill is \$68 per tonne higher than it is in Montreal, as noted earlier. Dry cargo tariffs from Winnipeg to Churchill are \$123 per tonne in carload quantities. If NTCL could absorb these additional costs, it would be in a good position to compete in adjacent Sealift ports. The feasibility of this was examined in terms of cargo for Cape Dorset and Lake Harbour in Hudson Strait.

It was found that NTCL's marginal costs for the two trips to Cape Dorset and Lake Harbour would be sufficiently small that they could absorb the additional cost of oil in Churchill and the cost of transporting dry cargo from Winnipeg to Churchill, and therefore be able to deliver these cargoes at the two Arctic ports at a cost lower than those associated with the Eastern Arctic Sealift. It appears to be economic, therefore to expand NTCL's territory to include the eastern end of Hudson Strait, despite the higher cost of supplies in Churchill, but a mechanism would have to be found to make the service attractive to Cape Dorset and Lake Harbour residents (e.g. by marginal pricing). A similar conclusion is reached regarding the Port of Sanikiluaq.

Use of Churchill by Sealift or Other Resupply Vessels

The Sealift organizes its bulk fuel deliveries in tankers and its dry cargoes in contracted Canadian vessels. Either of these types of vessels could, after delivering a load to one Arctic region (such as Hudson Strait) proceed to Churchill for reloading and deliver a subsequent cargo to another region (such as Foxe Basin). The Hudson's Bay Company

are also interested in operating their own and chartered vehicles in such a fashion. An economic assessment of this mode of operation was carried out.

If a tanker were to service the ports of Eastern Hudson Strait, for example, and then reload at Churchill to serve Foxe Basin destinations, it would save 12 days in comparison with a return round trip to Montreal. These 12 days would cost \$250,000 or \$35 per tonne; since fuel is \$68 per tonne more expensive in Churchill than in Montreal, it is not economical to use Churchill at current prices. For Churchill fuel to be competitive it would be necessary to find an off-shore supplier who would be prepared to deliver refined product to Churchill in relatively small quantities (17,000 tonnes per year maximum) for a total price not more than \$35 per tonne above the Montreal price. Esso have indicated that they would not be interested in such an operation.

Similarly, if dry cargo vessels were to use Churchill to reload after delivering their first Sealift cargo, they would each save 12 days of sailing time or about \$84,000 in comparison with returning to Montreal. Since the additional cost of transporting dry cargo from Winnipeg to Churchill is at least \$123 per tonne, the dry cargo vessel would make a net saving by using Churchill if the volumes to be loaded there were less than 680 tonnes; above this value it would be worth returning to Montreal. In 1984 the average size of Sealift cargoes was approximately 1,000 tonnes, so that this opportunity does not appear economic for most vessels. However, if the shipping cost from Winnipeg to Churchill were sufficiently reduced, the opportunity could become economic. This possibility would be enhanced if Sealift vessel costs were to increase above the current level of \$7,000 per day. Both the Hudson's Bay Company and Arctic Cooperatives Limited have indicated an interest in shipping in such a way particularly since there are further advantages to them in using traditional suppliers in Western Canada. Moreover, the Hudson's Bay Company could make an additional trip with their own vessel in each season and thereby reduce their need for chartering. A rate of about \$80 to \$90 per tonne for cargo from Winnipeg to Churchill would make Churchill attractive to them, as illustrated in Exhibit 3.1 of the report.

Conclusions on Marine Traffic

It is concluded that the most promising opportunity to extend NTCL services would be to serve Cape Dorset and Coral Harbour in Hudson Strait and possibly Sanikiluaq in the Belcher Islands. This additional tonnage could be handled with the existing equipment and crews and with a marginal extension of the shipping season if measures are taken to increase the productivity of the marine fleet. Among the latter would be the use of a dock at Rankin Inlet and the use of local resources to move cargo from the high water mark at major locations. NTCL would have to be permitted to charge lower rates based on marginal costing to permit the newly served communities to achieve the same landed cost of goods, particularly bulk fuel, as they do at present.

If a reduced cost of land transportation from Winnipeg to Churchill (e.g. to about \$80-\$90 per tonne) could be negotiated, it would be economically attractive for Sealift vessels and/or vessels of the Hudson's Bay Company based in Montreal to make two or three trips each to Churchill to take on resupply cargoes, before returning to Montreal at the end of the season. If such vessels were to make three visits each to Churchill in a single shipping season, approximately 10,000 additional tonnes of dry cargo would be supplied through Churchill in 1986 increasing to approximately 11,500 tonnes by 1989 and 15,000 tonnes by the end of the century based on projected population growth.

Finally, if NTCL were permitted to charge a sliding scale based on distance so that the marine/air rate ratio to south Keewatin destinations equals that in the north, the marine tonnes per capita in the south would be expected to rise to about 1.5. This would lead to a diversion of approximately 1,000 tonnes from air to marine. This increase would not require an additional trip to the Southern Keewatin communities and so would improve the productivity and cost recovery of the NTCL operation.

A Lower Cost Land Link From Winnipeg to Churchill

A lower cost land link from Winnipeg to Churchill would require the introduction of a piggyback trailer service. This is not in accord with the normal policy of CN which is to encourage piggyback transportation between major centres only. However, if significant new cargoes via Churchill can be developed by reorganizing the Eastern Arctic Sealift to deliver cargoes out of Churchill and if understandings can be reached with the Hudson's Bay Company and Arctic Cooperatives Limited to ship via Churchill (as they are interested in doing) assuming an appropriate rail service and rate, then the volumes could perhaps induce the railway to provide the service. Comparisons with piggyback rates charged by B.C. Rail to northern communities suggest that an all rail service from Winnipeg to Churchill or a road/rail service by road to Thompson and onward by rail, could be economically viable at about \$90 per tonne. An Eastern Arctic Sealift review in fiscal 1985/86 is considering the possibility of the Nunasi Corporation operating the Sealift from fiscal 1987/88 onwards. This offers the opportunity to consider the inclusion of Churchill routings in the Sealift process and to negotiate appropriate rates for these cargoes on the railway.

4. AIR RESUPPLY

Chapter 4 of the report discusses the rates and level of service between communities in the study area and Edmonton, Winnipeg and Montreal. It then discusses opportunities for expanding air service north into the study area from Winnipeg and Churchill.

Passenger Services

Fares generally are from \$0.30 to \$0.50 per nautical mile along the main air routes between major centres (such as Edmonton-Yellowknife or Montreal-Frobisher) rising to \$0.80 to \$1.40 per nautical mile at the periphery (e.g. Frobisher to Broughton Island or Cambridge to Gjoa Haven). The lack of a connection by an integrated system north from

Winnipeg means that fares in this corridor are the sum of a number of route segments, with no fare tapering at longer distances, leading to relatively high prices and a low level of service. Hall Beach to Churchill is 46 percent of the distance of Hall Beach to Montreal, yet the air trip costs 22 percent more and requires an overnight stop in Rankin Inlet. A round trip to Churchill from Hall Beach takes a week, compared with four days to Montreal.

Air Cargo Services

It is evident that, although Foxe Basin and central Baffin communities are nearer to Winnipeg than to Montreal or Edmonton, the present air route structures make it easier for services to be provided via Montreal. For Manitoba to obtain a share of the Arctic resupply traffic, it requires an integrated air service along an axis of Winnipeg-Churchill-Rankin Inlet-Hall Beach-Nanisivik-Resolute*. Communities along this axis are nearer to Winnipeg than to any other major metropolitan area. If an improved land link service can be arranged between Winnipeg and Churchill as described earlier, the study area communities would be served more cost-effectively from Churchill, as a source where freight can be readily and quickly available, than from any other comparable source in Canada.

While some air freight service requires immediate delivery by the next available flight, the prime choice in the Arctic communities is between once a year marine service or the alternative air service. In such a choice, the option of overland from Winnipeg to Churchill followed by air service may well provide a fully adequate level of service while being significantly less expensive than supply by air over the entire route.

* This service pattern was operated by Transair during the mid-1970's but was discontinued by its successor PWA in 1978 primarily due to weather delays. PWA currently operate an all cargo service from Winnipeg to the DEW Line Base at Hall Beach.

Conclusions on Air Traffic

Two options were considered: one the extension of the existing corridor from Rankin Inlet to Hall Beach and the second a further extension to Nanisivik/Resolute. Since Winnipeg does not have a significant advantage in terms of distance over Montreal and Edmonton in the corridor north of Hall Beach, and high quality service already exists there, it is unlikely that direct service from Winnipeg to points north of Hall Beach would be viable in the short term.

Traffic demand at Hall Beach might support a once weekly Winnipeg/Churchill orientated service by a 100 passenger aircraft operated in a combined passenger cargo configuration (also referred to as a "combie"). The present NWT service to Rankin Inlet operates twice weekly but overflies Churchill. The recommended corridor solution would be a direct combie service linking Winnipeg, Churchill, Rankin Inlet and Hall Beach. The practicability of this recommendation should be confirmed through a detailed analysis, necessary data for which was not available at the time of this study.

Both PWA and NWT have the capability to provide the suggested service. The NWT fleet consists of aging L-188's which could provide a short term solution but which would have to be replaced. They are also slow, considering the long distance involved. PWA operate a convertible B737 jet aircraft on passenger service from Winnipeg to Churchill and a DEW Line cargo service from Winnipeg to Hall Beach. Assuming adequate load factors, this aircraft would be better suited to the route but for efficient operation would require that the runways at Rankin Inlet be extended by approximately 500 feet to 5,500 feet. A precision approach instrument landing system would also be desirable. Hall Beach already has a 5,400 feet runway.

If Churchill is to maintain and expand its role as an air resupply centre for the Arctic, however, positive steps must be taken to ensure that goods and services required by inhabitants of northern

communities can be obtained there at prices competitive with those farther to the south, allowing for the extra transportation costs from Winnipeg or Thompson. As discussed more fully in the body of the report, this means that:

1. Lower road/rail rates must be negotiated for moving dry goods to Churchill;
2. Service improvements are required to reduce trans-shipment loss/damage; and
3. Institutional changes are needed so that surface/air resupply services through Churchill can be arranged through one agency.

If these changes are not made soon, there is a strong likelihood that air resupply services will be provided increasingly from communities farther south and Churchill's role will be increasingly eroded.

5. OPERATIONS AND INFRASTRUCTURE

Chapter 5 of the report, with supporting data in Appendices A, B and D, discusses the physical requirements at Churchill and the northern communities for the types of changed resupply operations proposed in this study.

It is concluded that the proposed use of Churchill as a secondary resupply base by Sealift vessels could be accommodated in terms of berthing and open storage space but that the Sealift or its customers or agents would have to make arrangements for covered storage facilities outside the Port area. Existing marine facilities at the six Keewatin ports are adequate for continuing NTCL resupply operations, although some improvement to the wharf at Rankin Inlet could be economically justified in terms of reduced unloading times.

Airside facilities at Churchill Airport are adequate for the proposed air resupply role but cargo handling facilities would have to be improved by the carriers. Passenger terminal improvements are desirable

and we understand that a new facility is planned to be built in 1987/88 under the Churchill Sub-agreement. Airport improvements at the relevant Arctic communities would not be required although an Instrument Landing System would be desirable at Rankin Inlet in view of its role as an air hub in the region and as an alternate to other airports in the vicinity.

6. EVALUATION AND CONCLUSIONS

Chapter 6 of the report summarizes the opportunities identified in previous chapters and evaluates the implications of implementing them and their sensitivity to various factors which might change the conclusions. It then discusses possible mechanisms and strategies for implementing the most viable opportunities.

The expansion of NTCL territory brings both additional dry cargo and bulk fuel shipments through the Port of Churchill whereas attracting Sealift vessels brings only dry cargo shipments. From this point of view, therefore, the expansion of NTCL would be a marginally preferred option.

However, resupply by the Sealift vessels would increase the area that would be served from Churchill, dramatically increasing its role as an Arctic resupply centre to the benefit of both the Northern and Western economies. It would also allow Montreal cargoes to the NTCL points to be transshipped through Port Churchill to the benefit of Eastern Canadian suppliers.

The NTCL expansion option is probably more vulnerable in the longer term since fuel costs are higher in Churchill than in Montreal and, if world oil prices continue to drop, there may be increasing pressure to supply the Keewatin with fuel from Montreal. Since bulk fuel provides 73 percent of NTCL's cargo and almost 40 percent of its cargo revenue, it would be doubtful that NTCL could continue to operate delivering dry cargo

alone under these circumstances*. Attraction of existing Sealift traffic to Churchill by having Sealift or Hudson's Bay Company vessels make two or three interim trips to Churchill for resupply cargoes before returning to Montreal would establish a mechanism for Keewatin dry cargo service to be maintained from Churchill should bulk fuel be supplied from Montreal and NTCL's service as presently constituted cease. As NTCL's traffic volumes increase with population growth, its surplus capacity necessary to add new areas will diminish. The additional Hudson Strait volumes amount to 25 percent of existing demand and correspond to nine years of growth from 1984 levels at the "base line" growth rate. As noted earlier, for NTCL to accommodate Hudson Strait traffic it would be desirable for NTCL to achieve significant productivity increases in operation through possible wharf construction and the use of local delivery personnel. For the above reasons, it is concluded that expansion of NTCL services offers less scope for expansion of Churchill resupply than would the attraction of Sealift vessels to Churchill. The two options could well prove compatible.

An NTCL distance-based tariff (lower in the south and higher in the north) could divert 1,000 tonnes annually from air to marine to the south Keewatin. This diversion, if achieved, would result in lower costs to the Keewatin as a whole, since NTCL revenues would increase by a lesser amount than air revenues would decrease. The option is therefore recommended. The new scale will need to be negotiated between NTCL and Transport Canada and included in the agreement between them. For evaluation purposes, this increase to NTCL is estimated to reduce unit toll and charter air cargo volumes by 500 tonnes each.

* However, if a cheaper off-shore source of fuel for Churchill resupply could be found, or if NTCL were to restructure its operations to make more effective year round use of existing or possibly new equipment, it might well provide a service that would be competitive with Sealift vessels (assuming lower railway freight rates).

a The tonnages of dry cargo to be shipped on surface routes to Churchill for the recommended options are estimated to be as follows by 1989:

Existing Churchill Supply	3,400 tonnes
Existing NTCL Service	8,500 tonnes
Existing Air Cargo	10,800 tonnes
Attraction of Montreal-based vessels	11,500 tonnes
Additional Air cargo	<u>2,900 tonnes</u>
TOTAL	37,100 tonnes*

In terms of 13.7 m (45 ft.) trailers, carrying average loads of 20 tonnes each, the 1989 volume would be equivalent to 1,850 trailers per year. Of these, 1,160 would be over the 13 week marine shipping season while 690 would be spread over 12 months. In peak weeks, therefore, the demand could be for the equivalent of 100 trailers per week. Some of the freight would, of course, be shipped in boxcars rather than trailers. These volumes appear high enough to be of interest to the railway and could possibly justify a higher frequency service than the present tri-weekly one.

Sensitivity to Outside Factors

The tonnage estimates are sensitive to a number of factors of which the most important are:

- o attainment of the base line forecasts;
- o growth of cargo demand in proportion to population growth;
- o maintenance of the approximate 50/50 modal split between marine and air cargo; and
- o the continued price differential between Churchill and Montreal bulk fuel prices.

* Basis 1984 actual volumes expanded to 1989 assuming a 2.7 percent annual growth rate in accordance with projected population growth.

The base line forecast assumes continuing population growth based on natural increase but no net immigration. This is conservative in that net immigration could occur if there were renewed mining activity or oil exploration in the resupply area while net out-migration is unlikely based on past experience. It is therefore more likely that demands arising from this factor will increase rather than decrease in which case the base line forecast would be exceeded.

The resupply cargo estimates assume that per capita demand for bulk fuel and dry cargo will remain constant, such that cargo growth will be proportional to population. It is possible that there will be further conservation in fuel consumption per capita, reducing the estimated demand, but there is no obvious factor which would lessen per capita demand for dry cargo. Significant reductions in per capita fuel consumption (e.g. by more than 5 percent or 10 percent) are considered very unlikely since high oil prices have already resulted in conservation measures; indeed recent decreases in world oil prices, if sustained, could restrain price increases during the next five or ten years suggesting that it would be more likely for per capita fuel consumption to increase rather than decrease in the short term.

The air mode had been gaining an increasing share of the resupply market until the NWT Government effort restored the marine share in 1984 and 1985. It is possible that the air resupply share might increase in future as larger more efficient aircraft are introduced. In this case the air resupply volumes would increase above those projected and the marine resupply volumes would be correspondingly reduced. It is therefore important from a strategic point of view to ensure the competitiveness of both the air and marine modes through Churchill, so as to retain traffic for the community and for Manitoba regardless of resupply mode. Attractive rates on the Churchill railway are the key factor in achieving this objective.

The disadvantage of Churchill as a bulk fuel resupply port lies in its high cost of supply by rail. Before 1974, oil was supplied by tanker from off-shore refineries. The study has not identified a potential off-shore supplier who would be interested in supplying Churchill at a price equal to or marginally above the Montreal price. However, the oil market is at present very volatile and the opportunity for off-shore oil supply could arise again. The oil resupply market in Hudson Bay and Hudson Strait (amounting to about 75,000 tonnes of fuel in 1989) could then be an economically viable commodity movement for Churchill.

Mechanisms and Strategies for Implementation

To achieve the increased flow of marine resupply cargoes through Churchill in accordance with the economic opportunities described earlier, three developments would have to occur simultaneously:

- o the three major shippers would have to indicate the volume of cargo that they would be prepared to commit for transport via Churchill;
- o the railway would have to offer a lower cost freight service from Winnipeg to Churchill;
- o the split between Churchill and Montreal cargoes would have to be determined between NTCL and Sealift vessels at Churchill.

A procedure would have to be developed for calling of tenders and awarding of contracts for resupply from both Montreal and Churchill. Minimum cargoes would have to be guaranteed by the three major shippers for each service. This allocation would also have to take into account the desirability of expanding the NTCL barge service from Churchill. Initially this would be a very complex process but once it was established, the marketing preferences of the shippers would determine the preferred cargo allocations.

The Sealift ordering and resupply process is a cooperative one coordinated by the Canadian Coast Guard. It has been proposed that the Government of the Northwest Territories might set up a development agency to take over the coordination function from the Coast Guard in fiscal year 1987/88. It may be appropriate for the Province of Manitoba to become associated with the Eastern Arctic Sealift coordination function, since it is in Manitoba's interest to encourage the use of goods produced in Winnipeg for Arctic resupply. Possibly a joint NWT/Manitoba agency could coordinate the Manitoba related Sealift function.

To achieve the lower cost rail link from Winnipeg to Churchill, the railway would have to offer a service designed for the higher volumes. Given the fact of only once a week freight service from Winnipeg, the Winnipeg-Thompson road link plus a transfer of trailers onto cars designed to receive trailers easily for shipment with the passenger trains appears to be the practical solution. At Churchill the trailers would either be transferred to the vessels direct (as desired by some of the shippers), off-loaded for transshipment in consolidated form, or driven to the airport for air cargo resupply.

It may be that the railway will require some guarantee of minimum annual volumes to make the necessary service commitments and to introduce a new rate. Such guarantees may be able to be given by the principal shippers for the NTCL and Sealift cargoes and the Province of Manitoba for the Town of Churchill known minimum requirements. The Hudson's Bay Company and Arctic Cooperatives Limited have indicated a strong interest in shipping through Churchill. These shippers could well be included in the Sealift coordination function. They may be willing to give commitments on quantities to be shipped as part of any rail rate guarantee that may be required.

The air corridor north from Rankin Inlet has relatively low passenger demand and the extended service would also be in competition with Nordair out of Montreal. The presence of air cargo via Churchill would therefore be a significant factor in providing revenue to support

the proposed route extension to Hall Beach. Extension of the Winnipeg North air link would thus logically follow the establishment of a reliable higher volume, lower cost land link based on marine cargoes; the potential for a more uniform year round demand for air cargo volume could be a factor justifying lower rail tariffs.

For the air cargo service to be more effective, a single agency should coordinate all stages of the movement. In this way a customer could deal with a single agency when making a shipment and this agency would be responsible for ensuring delivery. This coordination function could be provided by a freight forwarder, by the airline in cooperation with the railway, or by an agency established by the Province of Manitoba or the Northwest Territorial Government or both.

It is not evident at this stage which airline, if any, could best provide the proposed service. Pacific Western operates the Winnipeg-Churchill link and serves Resolute from Edmonton and Cambridge Bay. Northwest Territorial operates the Winnipeg-Rankin Inlet link and serves Hall Beach also from Edmonton and Cambridge Bay. The Winnipeg North link would therefore compete with the existing service of these carriers from Edmonton and the west. However these airlines with their western bases appear to be logical contenders for the route. Calm Air, headquartered in Thompson and serving the Keewatin, would be an alternative but it would face competition from Pacific Western on the Winnipeg-Churchill leg and from Northwest Territorial on the Winnipeg-Rankin Inlet leg, which would pit a small airline against two larger ones on the highest volume sector of the route.

It is proposed that discussions with Pacific Western Airlines and with Northwest Territorial be the first step in the establishment of the proposed Winnipeg North air route and that such discussions be held after the prospects for a restructured Sealift and Churchill resupply land link have been clarified, but not necessarily finalized.

Summary: Proposed Action Plan

Based on the above conclusions and recommended strategies for preserving and expanding rail, marine and air resupply operations through Churchill, the following action plan is proposed:

1. The proposed integration of the Churchill and Eastern Sealift operations will require an expansion of the coordination function currently performed by the Canadian Coast Guard to include marine shipments from Port Churchill. Also some form of coordination will be necessary on the land link to Churchill for marine resupply cargoes, and the complete service for air resupply. Some of the considerations involved affect areas well beyond the study area boundary. The three groups who have the broadest interest and responsibility are the Northwest Territorial Government, various branches and agencies of the federal government and the shippers. The Manitoba Government, CN, NTCL, the air carriers and the marine shipping companies have a direct interest in more limited areas. It appears therefore that the lead role in the restructuring of the resupply system should be taken by the Northwest Territorial Government with the support of the federal government in consultation with the shippers and various agencies and organizations having areas of specific interest.
2. The Government of the Northwest Territories in consultation with the major shippers and the Government of Manitoba should discuss with the Canadian Coast Guard the feasibility of a combined Sealift operation whereby some Eastern Arctic Sealift vessels, having delivered their initial load of cargo from Montreal, would make interim calls at Churchill to pick up new supplies for Arctic communities rather than returning directly to Montreal. Under this arrangement, a vessel would leave Montreal, deliver its first cargoes (for example to communities in Arctic Quebec and Hudson Strait), pick up new supplies at Churchill and resupply another set of Arctic communities, repeat this sequence a second and possibly a third time, and then proceed back to Montreal at the end of the season. The sailing time and costs saved by using Churchill as a secondary base in this manner would offset the additional price of commodities at Churchill, provided that reduced rail and truck rates

could be negotiated (based on the increased volumes) in line with similar rail/truck rates offered on northern routes in other parts of Canada. The objective of these discussions would be to achieve an agreement by the Canadian Coast Guard and the users of the Sealift service to use Churchill as a secondary resupply base in this manner provided that appropriate rail and road rates from Winnipeg to Churchill can be achieved.

3. the Northwest Territorial Government, again in consultation with the Manitoba Government and the major shippers, should discuss with NTCL and the Canadian Coast Guard the practicability of expanding the NTCL services within Hudson Bay and Hudson Strait. The objective of these discussions would be to determine the volume of additional cargoes that might be transported through Churchill. Depending upon the outcome of Step 2, Step 3 may or may not be relevant. For example, if only dry cargo is to be delivered to the proposed extended NTCL area, then NTCL would not be competitive. However, as a general policy and other factors being equal, the expansion of NTCL services should be encouraged over expansion of Sealift activities because the Corporation is locally owned, and it should be the policy of the Northwest Territorial Government to encourage local initiative, whenever it is feasible to do so.
4. In parallel with Steps 2 and 3, the NWT government with the support of the Manitoba Government and Transport Canada should enter into negotiations with CN and appropriate trucking firms with the objective of achieving increased service and reduced rates overland from Winnipeg to Churchill, reflecting the increased volumes achievable from Steps 2 and 3 and from increased air resupply activities through Churchill (see Step 6 below). It may be that guarantees of minimum annual volumes will have to be made as part of these negotiations.
5. The Government of the Northwest Territories should enter into negotiations with the Hudson's Bay Company and Arctic Cooperatives Limited regarding these companies' commitments on quantities to be shipped as part of any rail or marine rate guarantees that may be required.
6. The Government of the Northwest Territories, with the support of Transport Canada, should confirm the desirability of deregulating the Winnipeg/Churchill/Rankin Inlet/Hall Beach corridor or formulate some other mechanism for increasing competition and

improving the level of service over that currently prevailing. This assessment would include possibly redefining the unit toll role of the local carriers such as Calm Air and Keewatin Air. The practicability of allocating a guaranteed proportion of the forwarded cargo to interested carriers through a tendering process should also be assessed.

7. The feasibility of contracting out the coordination of road/rail shipments to both the air and marine modes to a single private operator should also be examined. The operator could also be either a private consortium or a private/public consortium with the Government of the Northwest Territories in consultation with the Manitoba Government providing the policy framework and information support.
8. NTCL and Transport Canada should enter into negotiations with NTCL to achieve a distance-based resupply tariff to compete with air tariffs. This tariff should provide lower marine rates to the South Keewatin communities and higher marine rates to those in the North Keewatin. It would result in lower resupply costs to the Keewatin as a whole since NTCL revenues would remain the same in total but air revenues would be reduced reflecting a shift from air to marine resupply of South Keewatin communities.
9. The longer term future of the NTCL operation is linked to the finding of a cheaper source of fuel at Churchill than the Western Canadian refineries currently supplying the Port by rail. The practicability of renewing off-shore imports, as was practised until the late 1970's, should be examined.

If the recommended action plan is followed and achieved there would be a number of benefits to the economies of the study area, Manitoba, Winnipeg and Churchill resulting from the additional tonnages of dry cargo for Arctic resupply to be shipped through Churchill. These would amount to an estimated 12,500 tonnes of marine and air traffic per year based on 1984 volumes (10,000 tonnes through the proposed use of Churchill as a secondary resupply base for Montreal based vessels and 2,500 tonnes of additional air cargo carried by the expanded Winnipeg North air service). This would increase to approximately 14,400 tonnes by 1989 based on the projected population growth rate of 2.7 percent per annum. When added to the existing (1984) NTCL volume of 7,400 tonnes of

dry cargo carried by NTCL, the existing 9,000 tonnes of air cargo moving through Churchill and the existing Churchill supply by rail of about 3,000 tonnes (19,400 tonnes in total), this produces a total estimated 1984 volume of about 62,400 tonnes per year, including bulk fuel over the Winnipeg/Churchill rail link.

The recommended action plan, if achieved, would lead to marginal increases in jobs and income in Manitoba (about 250 jobs and \$4.5 million in labour income) which would be largely offset by similar decreases of jobs and income in the Montreal and Edmonton regions. More importantly, the new services would produce a net reduction in both marine and air resupply rates to most Arctic communities in the study area. Substantially improved air services for resupply cargoes (and for passenger services if a combined cargo/passenger service is provided) would also be achieved in the corridor north of Churchill, serving Rankin Inlet, Hall Beach, Nanisivik and Resolute. The affected communities north of Churchill would experience a substantial increase in convenience and reduction in cost for air service to the nearest communities lying south of them, e.g. Churchill and Winnipeg. A related, less tangible benefit would be a strengthening of the resupply role of Churchill and therefore of its viability as a strategic centre to help achieve other sovereignty, defence and economic objectives in Canada's North.

1. INTRODUCTION

1.1 OBJECTIVE

The objective of this study as stated in the terms of reference is "to evaluate options to preserve and expand rail, marine and air resupply operations at Churchill". This report presents the findings of the study team and describes the methods by which more marine and air cargoes may be routed through the community of Churchill to resupply communities in Hudson Bay and the Arctic (see Exhibit 1.1). The role of the CN Rail line to Churchill in support of these activities is also examined.

1.2 SCOPE

The study examines the existing air and marine resupply services into the area north of Churchill and estimates the amount of resupply cargoes which will be demanded in future years by communities presently served from Churchill or potentially able to be served from it. It identifies the opportunities for routing more cargoes through Churchill and examines the reasons why such movements do not presently take place. Based on this analysis, it poses some options for Churchill, evaluates these and recommends a strategy for implementation. Sensitivity analyses are made as appropriate.

1.3 EVALUATION METHODOLOGY

Since most shippers are concerned primarily with transporting goods at the lowest cost consistent with a satisfactory level of service, the analysis has attempted to identify methods of introducing new transportation systems or routings through Churchill which offer the potential of being lower in cost (including the cost of supplies procurement) than existing systems or routings. Opportunities have been evaluated on the basis of their potential to divert traffic through Churchill from existing competing routes.



1.4 REPORT STRUCTURE

The technical assessments fall into major groups corresponding to the five chapters which follow:

2. Present Services and Projections
3. Marine and Rail Resupply
4. Air Resupply
5. Operations and Infrastructure
6. Evaluation and Conclusions

2. PRESENT SERVICES AND PROJECTIONS

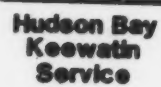
This chapter describes the existing and potential resupply area, its population and its present marine, rail/road and air services. It presents information on the amount of cargo delivered by each of the major services into the region. It presents projections of population to the year 2004 and makes cargo projections based on the projected population levels. These are base case projections inasmuch as policy changes such as those recommended in this report would, if implemented, change the traffic volumes projected on the basis of present trends and policies.

2.1 STUDY AREA

The Keewatin region of the Northwest Territories is generally considered as the basic area serviced by resupply operations from Churchill. However, as discussed later in this report, the potential resupply area is larger than this based on the relative distances from the three primary resupply centres of Winnipeg, Edmonton and Montreal.

Exhibit 2.1 shows the existing routes used for marine resupply. Churchill serves the communities to its north within the Keewatin. The larger part of the Eastern Arctic is served from Montreal and other points in Eastern Canada. The Western Arctic is served through Mackenzie River Services. In examining possible future Churchill based marine resupply opportunities, it is reasonable to consider an area which extends north into Foxe Basin, northeast to the easterly entrance of Hudson Strait, east to the coastal communities of Quebec on the eastern and southern sides of Hudson Bay and James Bay and south to the Ontario coastline of Hudson Bay. The Fury and Hecla Strait effectively limits the Churchill marine resupply area on the northwest assuming present marine equipment, because of the severity of the ice conditions in the Strait. Beyond the eastern entrance to the Hudson Strait, the territory is more naturally serviced from Montreal; the open sea lanes allow earlier services than is possible from the Port of Churchill; there is no significant saving in sailing time in originating journeys to this area in Churchill rather than in Montreal. It is also possible that a large port such as Frobisher Bay, although

.....
**Mackenzie River
 Western Arctic
 Service**



Eastern Arctic Sea Lift Service

outside the prime Churchill resupply area, could attract sufficient Western originating cargo to justify a service from Churchill on occasion. Thus a Montreal-based vessel after a voyage to Hudson Bay making a call at Churchill could pick up Frobisher-bound cargo and deliver it on the return journey to Montreal.

For the purposes of determining air service requirements, the Arctic communities may be divided into three zones, based on the distances from Montreal, Winnipeg and Edmonton. Exhibit 2.2 shows the boundaries, with all points in Zone A being closer in air miles to Montreal and all those in Zone B being closer to Edmonton. In practice, Edmonton services generally operate via Yellowknife so the exhibit also shows a modified Western Zone, Zone C, representing the area for which Edmonton (with a stop at Yellowknife) is closest.

The area lying between the Zone A and Zone C boundary lines in Exhibit 2.2 has been taken as the prime study area for investigating the feasibility of expanding air services through Churchill. This area includes Keewatin, the eastern communities of Kitikmeot and parts of Baffin Island. Communities such as Frobisher Bay which lie just outside the zone boundaries are considered to be more naturally tributary to Montreal and outside the prime study area. However, they could generate some traffic on the Winnipeg-Churchill corridor in some circumstances as will be discussed.

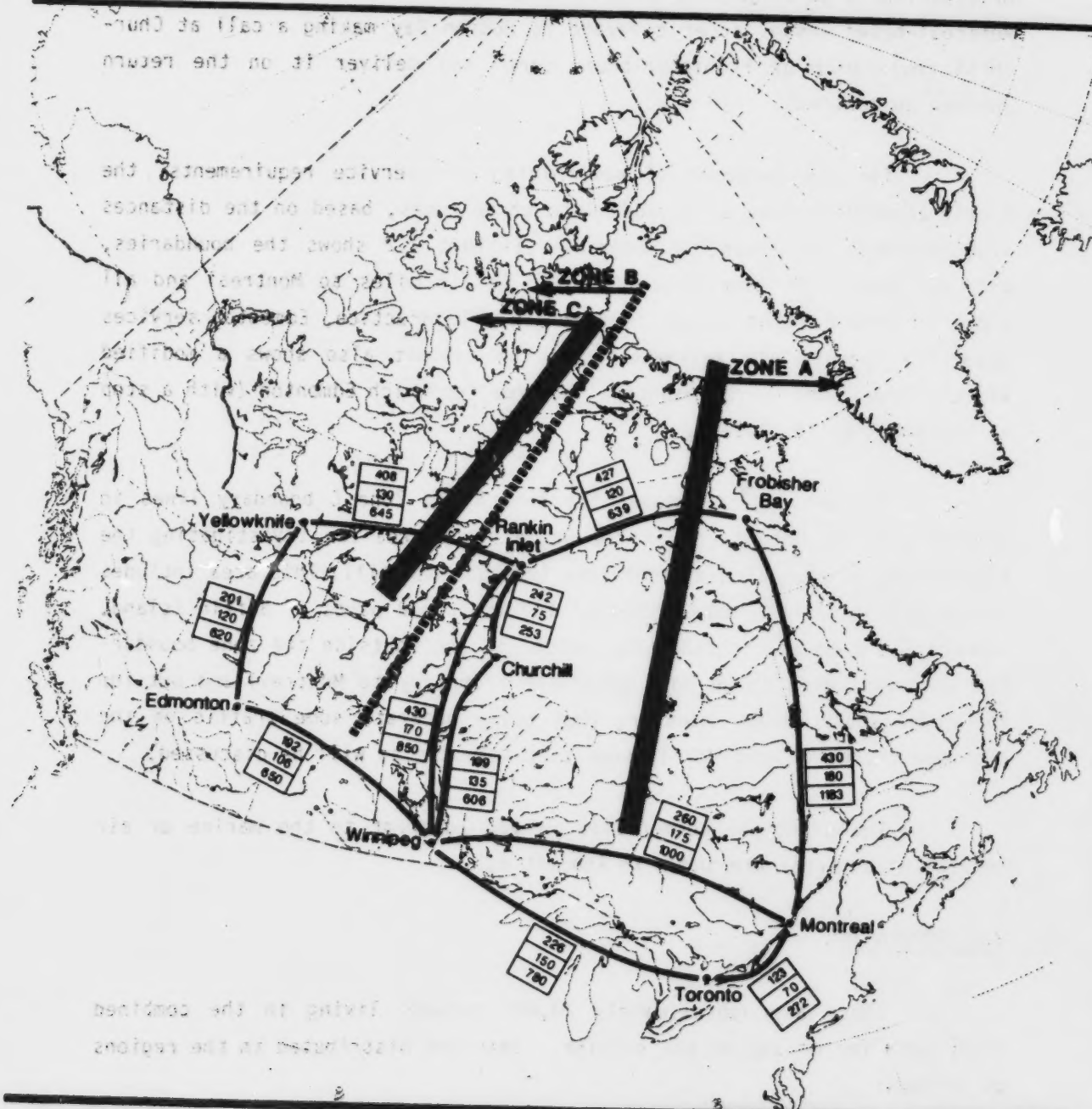
The principal communities in and adjacent to the marine or air service study areas are shown in Exhibit 2.1.

2.2 POPULATION

There are approximately 20,000 persons living in the combined study area for marine or air service. They are distributed in the regions as follows:

- o the Eastern Kitikmeot region 1,400;

exhibit 22
AIR RESUPPLY
CHURCHILL PREFERENTIAL ZONE



ZONE A
Montreal / Frobisher
air distance advantage
over
Winnipeg

ZONE B
Edmonton
air distance advantage
over
Winnipeg

ZONE C
Edmonton via Yellowknife
air distance advantage
over
Winnipeg via Churchill



- o Keewatin (excluding Repulse Bay) 4,400;
- o Foxe Basin, Hudson Strait and North Baffin (plus Repulse Bay but excluding Sanikiluaq); 5,000;
- o East side of Hudson Bay (including Sanikiluaq) 9,400;
- o Fort Severn and Winisk 400.

About 17,000 persons reside in the area being considered as potentially served by marine resupply wholly or partly from Churchill; about 10,000 are in the area considered to be the potential air service area. Of these persons, approximately 4,300 are currently directly serviced from Churchill by marine services and 4,700 by air. The population in each of the communities involved is shown in Exhibit 2.3.

2.3 MARINE SERVICES

There are three major routings for marine shipments into the Arctic communities - the Mackenzie River system, via Port Churchill and via Montreal. The routes generally followed by marine services from these sources are shown in Exhibit 2.1. The road and rail access routes to the Port of Churchill are shown in Exhibit 2.4. In addition, the port of Moosonee in James Bay offers marine services in James Bay and adjacent coastal communities.

Because of difficult navigational conditions in the Fury and Hecla Strait, the communities to its west are not considered potential to Churchill for marine services at this time. The remaining territories may be divided into four regions as follows:

- o Keewatin
- o Baffin
- o Arctic Quebec and James Bay
- o Ontario Shore of Hudson Bay

EXHIBIT 2.3

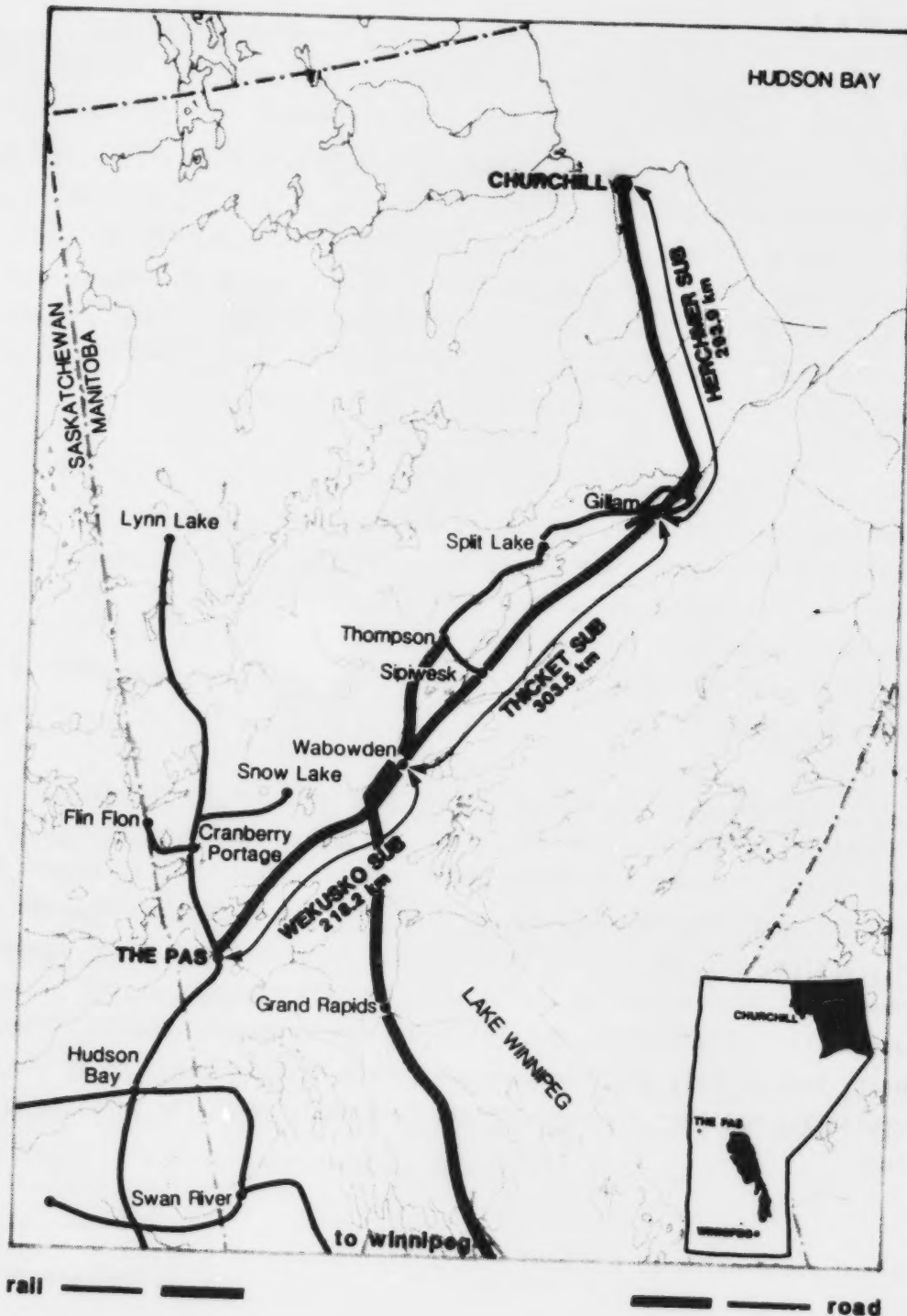
Population in Study Area Communities

Community	1981 Census Population	1984 Estimated Population	Marine Study Area?	In Air Study Area?
Eskimo Point	1022	1138	Yes	Yes
Whale Cove	188	206	Yes	Yes
Rankin Inlet	1109	1239	Yes	Yes
Chesterfield Inlet	249	251	Yes	Yes
Baker Lake	954	1014	Yes	Yes
Coral Harbour	429	432	Yes	Yes
KEEWATIN(excRepulse)	3951	4280		
Hall Beach	349	399	Yes	Yes
Igloolik	746	780	Yes	Yes
Repulse Bay	352	382	Yes	Yes
FOX E BASIN inc Repulse	1447	1561		
Cape Dorset	784	861	Yes	Yes
Lake Harbour	252	266	Yes	
HUDSON STRAIT	1036	1127		
Grise Fiord	106	135		Yes
Resolute	168	142		Yes
Nanisivik	261	279		Yes
Arctic Bay	375	439		Yes
Pond Inlet	705	805		Yes
Clyde River	442	500		Yes
NORTH BAFFIN	2057	2300		
Gjoa Haven	523	647		Yes
Spence Bay	431	454		Yes
Pelly Bay	257	278		Yes
EAST KITIKMEOT	1211	1379		
Ungava	1987	2170	Yes	
East Hudson's Bay	1984	2167	Yes	
James Bay	4232	4623	Yes	
Sanikiluaq	383	415	Yes	
EAST SIDE	8586	9375		
FTSEVERN/WINISK	420	415	Yes	
TOTAL	18708	20437		
MARINE STUDY AREA	15440	16758		
AIR STUDY AREA	9450	10381		

SOURCES:

Bureau of Statistics GNWT - Oct 85 Projections
Fort Severn/Winisk Report
IBI Projection of East Side at Arctic rate

SURFACE ACCESS TO CHURCHILL



Services into these regions are described below. More detailed information on marine resupply facilities at Churchill is provided in Appendix A.

2.3.1 Keewatin

Six ports in the Keewatin are served from Churchill by Northern Transportation Company Ltd. (NTCL): Eskimo Point, Whale Cove, Rankin Inlet, Chesterfield Inlet, Baker Lake and Coral Harbour. At the beginning of each year, NTCL publishes a schedule of the voyage departure dates to each community and goods have to be delivered to Churchill by a specified cut-off time if they are to be transported by NTCL. Marine resupply facilities at the six ports are described in Appendix B.

For this service, NTCL uses one tug and four barges. In normal operation, the tug takes two barges to a community, unloads the fuel at anchor and then beaches the barges to permit them to be off-loaded by crews flown in from Churchill. When off-loaded, the goods are taken to the customer's warehouse or specified locations. The tug then returns to Churchill with two empty barges and picks up two loaded barges for a trip to another community.

Repulse Bay, although administratively in the Keewatin, is not accessible to the NTCL tug and barges through Foxe Basin because of ice conditions. However ice survey data indicates that coastal access to it from the south via Roes Welcome Sound to the west of Southampton Island may be practical but the passage is considered hazardous because of inadequate soundings. Adding Repulse Bay to the Churchill resupply system raises the possibility of diverting the Pelly Bay air resupply traffic from Hall Beach; however this would require the runway at Repulse Bay to be improved. Repulse Bay has been grouped with the Foxe Basin ports for purposes of this study.

2.3.2 Baffin Island

The Baffin communities are principally served by the Eastern Arctic Sealift operating out of the St. Lawrence ports of Montreal (for Canadian cargoes) and Ogdensburg, New York (for United States cargoes for the USAF). The Canadian Coast Guard coordinates the operation. Tenders are called separately for fuel deliveries by tankers and for dry cargo deliveries by Canadian merchant vessels.

For the purposes of the Sealift the Eastern Arctic is divided into six territories as shown on Exhibit 2.5 designated by letters as follows:

- A. Quebec (as described in sub-section 2.3.3 below)
- B. Foxe Basin
- C. South Baffin, including Hudson Strait
- E. East Baffin
- F. Mid-High Arctic
- G. Thule

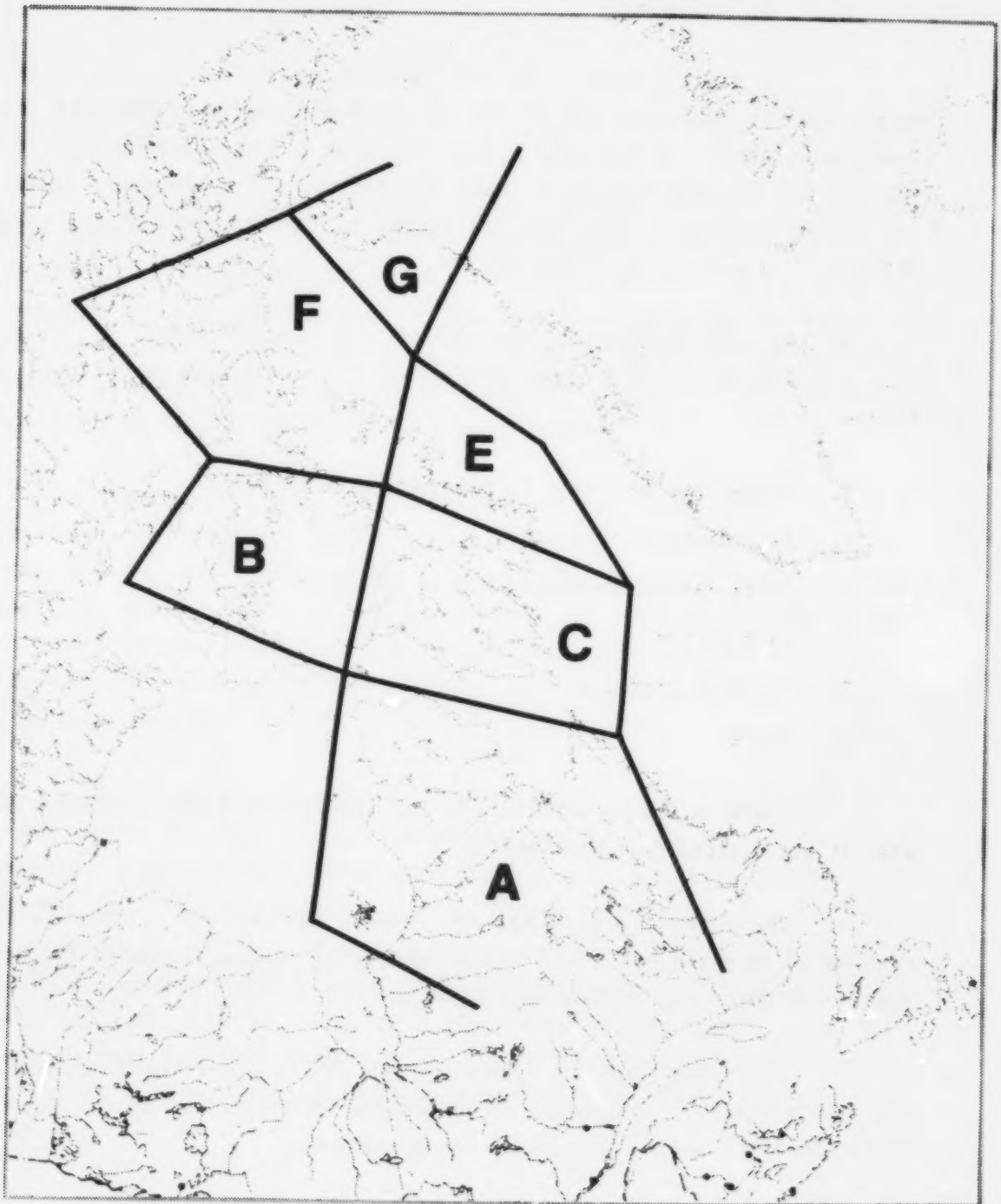
There is now no Territory D; Territory D was Keewatin before 1974 when it was dropped from the Sealift.

The Eastern Arctic Sealift vessels deliver dry cargoes to the high water mark and it is the responsibility of the consignee to transfer goods from there to his receiving location.

The mandate of the Eastern Arctic Sealift and the functions of the transportation coordinator are described in the report of the Eastern Arctic Sealift¹ and are reproduced as Appendix C.

1. Report of Eastern Arctic Sealift 1984 - TP2506 - Canadian Coast Guard, January 1985.

EASTERN ARCTIC SEALIFT DELIVERY AREAS



The Sealift vessels are permitted to carry additional cargoes for other shippers after they meet their Sealift commitments. The Hudson's Bay Company operates its own vessel, the MV Kanguk, which makes about three trips a year into the study area from Montreal and about two trips a year to Frobisher Bay and more northerly points in East Baffin and the Mid/High Arctic.

Private shippers such as Panarctic Oil and Cominco may also charter vessel voyages to mine site or exploration locations or to a supply centre such as Frobisher Bay.

Islands such as Sanikiluaq in Hudson Bay are administratively part of Baffin but for marine service may be considered with Arctic Quebec to which they are geographically related.

2.3.3 Arctic Quebec and James Bay

Quebec communities on the Eastern shore of Hudson Bay receive dry cargo from Montreal by a Quebec Government Sealift and by the federal government Eastern Arctic Sealift referred to above; the fuel service is by Shell Oil Limited. Moosonee Transportation Co. Ltd. offers service primarily to James Bay and adjacent communities.

The two sealifts are supplied by Canadian vessels which bid on contracts tendered for the transport of dry cargo by the Quebec and federal governments respectively. Shell Oil Limited delivers bulk fuel to the Eastern shore of Hudson Bay for the Quebec Government and to Sanikiluaq and Frobisher Bay for the Northwest Territorial Government. Moosonee Transportation Co. Ltd., delivers bulk fuel and construction materials out of Moosonee, normally using for each trip a tug and three barges which are suitable for the shallow harbour at Moosonee.

2.3.4 Ontario Coast of Hudson Bay

There are two small communities on the Ontario coast of Hudson Bay with no road or rail access: Fort Severn and Winisk. A study in November 1983 assessed their transportation requirements² and concluded that marine services would be economic. It noted that in discussions, NTCL had indicated that they were interested in serving the communities because they had only one tug and they did not wish to risk their commitments to Keewatin. Moosonee Transportation Co. Ltd., indicated an interest in offering such a service and are now supplying Fort Severn. Marine receiving facilities will have to be constructed before Winisk can be served.

2.4 RAIL AND ROAD SERVICES

Churchill is served by the Hudson Bay Railway, operated by CN Rail. Officials of the Government of the Northwest Territories in the Department of Government Services and in the Housing Corporation report that dry cargo destined for the Keewatin area and shipped by rail originates primarily in Winnipeg and secondarily in Edmonton. The link from Winnipeg to Churchill is of major importance to marine resupply operations through Churchill. As will be seen later, reductions in cost and improvements in level of service on this link offer the possibility of significant tonnage increases through Churchill. Operation of this system is described in Section 2.4.1 below.

Bulk fuel for the Keewatin is supplied from Churchill from storage tanks which are currently leased to Esso Canada Ltd. on a five-year contract which started in 1984. These tanks are refilled as required by fuel supplied by Esso's Edmonton refinery (normally by pipeline to Regina but sometimes to an alternate point) and then by tank car to Churchill.

2. Assessment of the Transportation Requirements of Fort Severn and Winisk in Northern Ontario, Ontario Ministry of Transportation and Communications, 1973.

2.4.1 Rail Shipments Through Churchill

The major part of the dry cargo shipments (both for the Keewatin and the potential expansion area) are handled by or on behalf of three organizations: The Hudson's Bay Co., Arctic Cooperatives Limited and agencies of the NWT Government. These organizations in turn use the services of three transportation companies or forwarding organizations: Costa Cartage, Federated Co-operatives and CN Route Trucking.

Although rail is the only surface link to Churchill there are various combinations of modes and equipment used for cargo shipments from Winnipeg to Churchill. Most shipments are consolidated in Winnipeg, normally palletized and shipped north in one of three ways:

- o in full boxcar loads, directly from Winnipeg;
- o in highway trailers on flat cars by rail directly from Winnipeg;
- o in highway trailers by road to Thompson for transshipment by special piggyback railcars to Churchill.

There are several associated problems and bottlenecks which make the system awkward to use. These relate primarily to the trailer on flat car service from Winnipeg and the piggyback service from Thompson.

The piggyback service from Thompson is essentially a replacement for the express service that used to be offered as part of the passenger service. When the express service was discontinued, three flat cars were transformed into modified piggyback cars and provided with special equipment to permit them to be attached to the tri-weekly passenger trains. Trailer unloading and loading facilities were built at Thompson and Churchill and express customers were offered a modified highway/piggyback service from Winnipeg to Churchill.

This service is a modified Plan "A" service in that it is provided only by CN Route, CN's trucking subsidiary, who generally pick up goods in Winnipeg and Thompson. If the goods are picked up in Winnipeg they are trucked to Thompson for loading on the piggyback cars. Conversely, goods can be picked up directly in Thompson and loaded on the same cars.

The piggyback service is restricted to three trailer loads per train movement, or nine trailer loads weekly. Currently, it is underutilized during the nine months that the marine shipping season is closed but is fully utilized during the three month coastal shipping season. In fact, during the peak months of July and August from four to six boxcar loads are hauled directly from Winnipeg via the weekly freight train operated each summer.

The trailer on flat car (TOFC) service from Winnipeg is provided largely on a seasonal basis by one firm, Costa Cartage, and is basically a service that is integrated with the NTCL barging operation. The Costa organization acts as a freight forwarder. They have facilities in Winnipeg and Churchill and consolidate shipments into boxcars and highway trailers used in the TOFC service. For this latter service, the company has a fleet of flat and van highway trailers. These are normally loaded in Winnipeg and then fastened onto ordinary flat cars rented from the railway by the company. The loaded flat cars are then hauled to Churchill, usually by the weekly freight train supplemented during the height of the season by the grain trains. At Churchill, they are unloaded by the company and most of the goods moved directly onto barges for transportation further north.

Loose cargo arriving by rail is forwarded to the NTCL transit shed located opposite the deep sea grain loading berths. The transit shed has an area of approximately 8,000 square metres of which approximately 75 percent is leased by NTCL. Loose cargo is consolidated on pallets, shrink wrapped and stored before being loaded on the barges. Loose and bulk cargo not requiring weather protection is stacked in the open on the wharf.

The Port of Moosonee on James Bay is supplied by the Ontario Northland Railway (ONR). Goods for Moosonee are normally shipped by CN Rail or by truck from Southern Ontario to Cochrane and then onward via the ONR to Moosonee.

2.5 AIR SERVICES

Scheduled and charter air services are provided by the following carriers, with head offices as shown:

Nordair	- Montreal
First Air	- Ottawa
Pacific Western	- Calgary
Northwest Territorial Airlines	- Yellowknife
Calm Air	- Thompson
Kenn Borek Air	- Resolute.

In addition, there are charter operators with licenses to operate at specific airports in the study area:

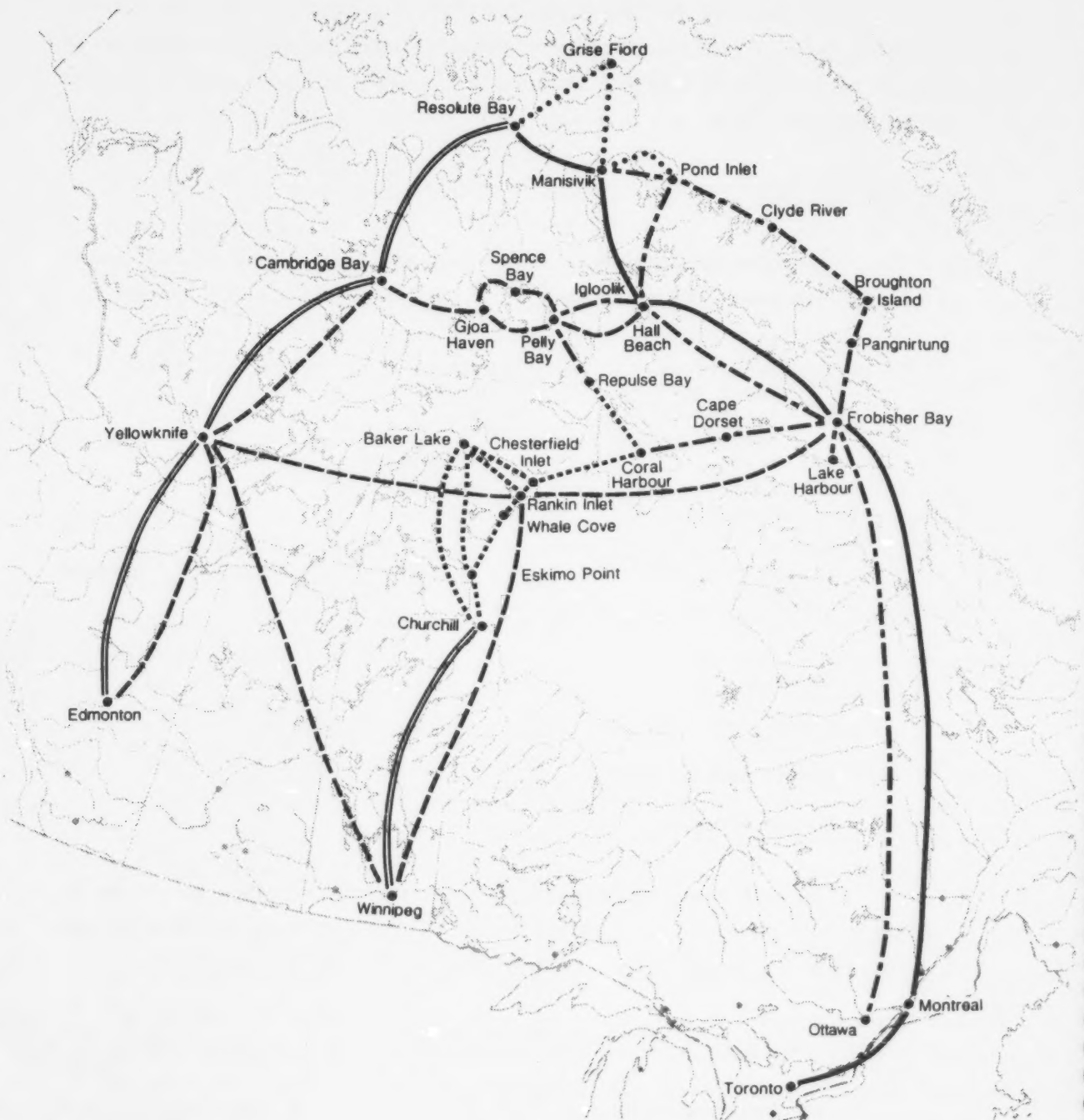
- o Keewatin Air
- o Bradley Air Services
- o Nunasi Central Airlines
- o Austin Airways.

The routes served by each of the scheduled carriers are shown in Exhibit 2.6. Information on each airport in the Northwest Territories and the companies licensed to operate from them is listed in Appendix D.

2.5.1 DEW Line and Military Installations

The towns of Frobisher Bay, Hall Beach and Cambridge Bay are located on the Distant Early Warning (DEW) radar line. Goods shipped there are redistributed by charter flights to points all along the DEW Line.

SCHEDULED AIR CARRIER ROUTES



NORDAIR
NORTHWEST TERRITORIAL
CALM AIR

IBI
GROUP

PACIFIC WESTERN
FIRST AIR
KENN BOREK AIR

Also because of navigation difficulties for cargo vessels and tankers, fuel and general cargo for Pelly Bay is airlifted from Hall Beach.

Resolute also has a special role, having a military installation in addition to its basic community functions. It also attracts a number of organized tourist parties.

2.6 MARINE CARGOES DELIVERED BY NTCL

This section provides data on Northern Transportation Company Ltd. (NTCL) operations with respect to:

- o the schedule and level of service offered;
- o the tonnages carried;
- o trends in marine cargo volumes.

2.6.1 Schedule and Level of Service

The arrival and departure dates of the NTCL service at each port for 1981 to 1985 are shown in Exhibit 2.7. On average, in each of the five seasons the tug made nine journeys with a total of eleven port stops (i.e. each journey was usually to a single port, such as Rankin Inlet, and occasionally a second port, such as Whale Cove, was served on the same journey). The average time taken for a journey was:

- o 1 day to load at Churchill;
- o 5 days round-trip sailing;
- o 2-1/2 days to unload at the first port;
- o 1/2 day representing the 20 percent of the time there was a second port (i.e. 20 percent of 2-1/2 days);
- o 9 days total.

EXHIBIT 2.7

ARRIVAL AND DEPARTURE DATES
(NTCL Keewatin Service)

-----NUMBER OF DAYS-----

Arrival at	Departure from	First Stop	Date Arr	Naut Miles	Second Stop	Date Arr	Naut Miles	At Churc -hill	To 1st Stop	To 2nd Stop	To Churc -hill
Churchill	Churchill										
1985	Jy 17	Eskimo Point	Jy 18	135				1	1		5
Jy 23	Jy 23	Rankin Inlet	Jy 26	255				0	3		5
Jy 31	Au 1	Whale Cove	Au 2	214				1	1		4
Au 6	Au 6	Baker Lake	Au 10	450				0	4		4
Au 14	Au 14	Baker Lake	Au 17	450				0	3		5
Au 22	Au 22	Coral Harbour	Au 24	454				0	2		11
Se 4	Se 4	Chesterfield	Se 5	289				0	1		4
Se 9	Se 9	Rankin Inlet	Se 11	255	Baker Lake	Se 15	450	0	2	6	4
Se 19	Se 19	Eskimo Point	Se 20	135	Whale Cove	Se 21	214	0	1	2	2
Se 23	Se 23	Rankin Inlet	Se 26	255				0	3		3
1984	Jy 25	Eskimo Point	Jy 27	135				2	2		4
Jy 31	Jy 31	Eskimo Point	Au 1	135	Whale Cove	Au 3	214	0	1	3	2
Au 5	Au 6	Rankin Inlet	Au 7	255				1	1		5
Au 12	Au 12	Baker Lake	Au 15	450				0	3		5
Au 20	Au 21	Coral Harbour	Au 24	454				1	3		8
Se 1	Se 2	Chesterfield	Se 4	289	Coral Harbour	Se 10	454	1	1	3	4
Se 14	Se 14	Rankin Inlet	Se 16	255				0	2		4
Se 20	Se 21	Baker Lake	Se 24	450				1	3		15
Oc 9	Oc 9	Rankin Inlet	Oc 10	255	Chesterfield	Oc 13	289	0	1	4	2
Oc 15	WINTER										
1983	Jy 20	Eskimo Point	Jy 24	135	Whale Cove	Jy 29	214	4	4	9	10
Au 1	Au 2	Eskimo Point	Au 3	135	Whale Cove	Au 6	214	1	1	4	2
Au 8	Au 10	Rankin Inlet	Au 12	255				2	2		5
Au 17	Au 18	Rankin Inlet	Au 20	255	Whale Cove	Au 22	292	1	2	4	2
Au 24	Au 26	Coral Harbour	Au 28	454				2	2		8
Se 5	Se 6	Chesterfield	Se 8	289				1	2		4
Se 12	Se 14	Baker Lake	Se 17	450				2	3		8
Se 25	Se 25	Baker Lake	Se 28	450				0	3		5
Oc 3	Oc 3	Rankin Inlet	Oc 5	255				0	2		3
Oc 8	WINTER										
1982	Jy 24	Eskimo Point	Jy 25	135					1		3
Jy 28	Jy 29	Whale Cove	Jy 30	214				1	1		3
Au 2	Au 4	Rankin Inlet	Au 6	255				2	2		6
Au 12	Au 12	Rankin Inlet	Au 14	255				0	2		3
Au 17	Au 18	Coral Harbour	Au 21	454				1	3		6
Au 27	Au 28	Chesterfield	Au 30	289				1	2		4
Se 3	Se 3	Baker Lake	Se 8	450				0	5		8
Se 16	Se 16	Rankin Inlet	Se 18	255	Baker Lake	Se 21	450	0	2	5	4
Se 25	WINTER										
1981	Jy 3	Eskimo Point	Jy 11	135					8		5
Jy 16	Jy 17	Whale Cove	Jy 19	214	Rankin Inlet	Jy 21	255	1	2	4	3
Jy 24	Jy 25	Rankin Inlet	Jy 27	255				1	2		5
Au 1	Au 1	Rankin Inlet	Au 4	255				0	3		3
Au 7	Au 8	Coral Harbour	Au 10	454				1	2		10
Au 20	Au 21	Chesterfield	Au 23	289				1	2		4
Au 27	Au 28	Baker Lake	Se 1	450				1	4		6
Se 7	Se 9	Baker Lake	Se 14	450				2	5		3
Se 17	Se 18	Rankin Inlet	Se 21	255	Eskimo Point	Se 24	373	1	3	6	2
Se 26	WINTER										
SOURCES: NTCL and Port of Churchill						Av.	0.8	2.4	4.5	4.9	

Since there were an average of 9 journeys, the ship was occupied on average for 81 days, with loading starting on average at Churchill on July 17 and the tug returning to its winter berth on average on October 4.

The normal number of services received by each port was:

Eskimo Point	2
Whale Cove	1 or 2
Rankin Inlet	3
Chesterfield Inlet	1 or 2
Baker Lake	2
Coral Harbour	1

The average tonnes delivered per stop was 1700, being as low as 200-300 tonnes per stop for Whale Cove and as high as 3,000 tonnes for Rankin Inlet, Baker Lake and Coral Harbour.

The average sailing speed to the first stop of a journey was 5.0 knots. The vessel is capable of seven or eight knots, but the first journey to Eskimo Point in ice is often slow; it is sometimes necessary to wait for the appropriate tide at some ports. The average speed to each port was:

Eskimo Point	2 knots
Whale Cove	6 knots
Rankin Inlet	5-1/2 knots
Chesterfield Inlet	7 knots
Baker Lake	5 knots
Coral Harbour	7-1/2 knots

2.6.2 Tonnages Carried

The annual tonnage delivered by NTCL to the six communities has varied between 15,700 and 24,500 tonnes in the eight years, 1978 to 1985, with an average of 21,000 tonnes.

Bulk fuels have accounted for between 70 percent and 80 percent of these cargoes, with an average of 73 percent. The proportion is higher

in the three southern communities of Eskimo Point, Whale Cove and Rankin Inlet where bulk fuels account for 78 percent to 80 percent of the tonnage, compared with the three northern communities where fuels account for 70 percent to 75 percent of the tonnage. This is believed to be due to the greater use of air for dry cargo by the southern communities. The price differential between air and marine is lower in the south because the NTCL tariff is the same for 135 nautical miles to Whale Cove as it is for 450 nautical miles to Coral Harbour. The tariff is included in the agreement between the owners of NTCL and the Government of Canada. A change to the tariff to reflect distance would therefore require an amendment to this agreement.

The effect of the narrow tariff differential prevailing in the southern portion of the study area is confirmed when the marine tonnages to each community are examined on a per capita basis for an eight-year period:

	MARINE CARGO TONNES PER CAPITA			
	DRY CARGO		BULK FUELS	
	Range	Average	Range	Average
<u>Southern Group</u> Eskimo Point, Whale Cove and Rankin Inlet	0.6 to 1.2	0.9	2.4 to 4.3	3.45
<u>Northern Group</u> Chesterfield Inlet, Baker Lake and Coral Harbour	1.4 to 1.8	1.6	3.5 to 4.4	3.75
All Communities	0.6 to 1.8	1.3	2.4 to 4.4	3.6

The amount of dry cargo per capita is almost twice as high to the northern communities as to those in the south.

2.6.3 Tonnage Trends

There is no clear trend in NTCL cargoes over the eight-year period examined. Exhibit 2.8 shows the tonnages by community by year, broken down into dry cargo and bulk fuel.

EXHIBIT 2.8
NTCL Keewatin Operations
1978 -85
(tonnes)

DESTINATION	Dry Cargo										Av Tonnes /cap	%
	1984 Popn	1978	1979	1980	1981	1982	1983	1984	1985	78-85		
Eskimo Point	1138	1306	688	504	558	273	559	790	755	679	0.60	12.0
Whale Cove	206	454	42	174	152	70	96	241	470	212	1.03	3.7
Rankin Inlet	1239	1111	1297	1885	2123	1103	840	2006	1377	1468	1.18	26.0
Chesterfield	251	272	157	239	227	312	426	779	365	347	1.38	6.1
Baker Lake	1014	1766	2203	1887	1487	462	652	1854	1694	1501	1.48	26.5
Coral Harbour	432	683	1438	920	749	343	383	1231	499	781	1.81	13.8
SUBTOTAL	4280	5592	5825	5609	5296	2563	2956	6901	5160	4988	1.17	88.2
RETROGRADE	4280	469	243	1111	485	1031	934	523	552	669	0.16	11.8
TOTAL	4280	6061	6068	6720	5781	3594	3890	7424	5712	5657	1.32	100.0
% of Total Cargo		26.4	26.0	31.2	30.0	23.0	19.9	30.3	25.9	26.8		

DESTINATION	Bulk Fuel										Av Tonnes /cap	%
	1984 Popn	1978	1979	1980	1981	1982	1983	1984	1985	78-85		
Eskimo Point	1138	3251	3671	1865	2505	1826	2995	3092	2560	2721	2.39	17.6
Whale Cove	206	874	926	1214	1038	225	515	954	801	818	3.97	5.3
Rankin Inlet	1239	5652	4966	4967	4647	4648	6422	6128	5513	5368	4.33	34.8
Chesterfield	251	1296	1272	1300	726	649	743	1100	1050	1017	4.05	6.6
Baker Lake	1014	3886	4584	3150	2558	3059	3496	3622	4312	3583	3.53	23.2
Coral Harbour	432	1920	1812	2333	2013	1655	1532	1991	2068	1916	4.44	12.4
SUBTOTAL	4280	16879	17231	14829	13487	12062	15703	16887	16304	15423	3.60	99.9
RETROGRADE	4280	0	0	0	0	0	0	187	0	23	0.01	0.1
TOTAL	4280	16879	17231	14829	13487	12062	15703	17074	16304	15446	3.61	100.0
% of Total Cargo		73.6	74.0	68.8	70.0	77.0	80.1	69.7	74.1	73.2		

DESTINATION	Total Cargo											
	1984 Popn	1978	1979	1980	1981	1982	1983	1984	1985	78-85	Av Tonnes /cap	% Bulk
Eskimo Point	1138	4557	4359	2369	3063	2099	3554	3882	3315	3400	2.99	16.1 80.0
Whale Cove	206	1328	968	1388	1190	295	611	1195	1271	1031	5.00	4.9 79.3
Rankin Inlet	1239	6763	6263	6852	6770	5751	7262	8134	6890	6836	5.52	32.4 78.5
Chesterfield	251	1568	1429	1539	953	961	1169	1879	1415	1364	5.43	6.5 74.6
Baker Lake	1014	5652	6787	5037	4045	3521	4148	5476	6006	5084	5.01	24.1 70.5
Coral Harbour	432	2603	3250	3253	2762	1998	1915	3222	2567	2696	6.24	12.8 71.1
SUBTOTAL	4280	22471	23056	20438	18783	14625	18659	23788	21464	20411	4.77	96.7 75.6
RETROGRADE	4280	469	243	1111	485	1031	934	710	552	692	0.16	3.3 3.3
TOTAL	4280	22940	23299	21549	19268	15656	19593	24498	22016	21103	4.93	100.0 73.2

Dry cargo had two extremely low years in 1982 and 1983 and officials report that there was a greater use of air cargoes in those years. In 1984, however, NTCL management attempted to show government shippers that a diversion to air meant not only a higher freight rate but also an increased marine subsidy. This may have resulted in the peak 1984 marine tonnages and in the 1985 tonnages which are also above 1982/83 levels although not as high as those achieved in 1984. In the 1984/85 period the amount of marine dry cargo to the communities served was equivalent to 1.5 tonnes per capita.

The apparent willingness of shippers to pay the increased costs associated with airfreight even during the navigation season can, however, be viewed as demonstrating a perceived level of service deficiency in the marine mode. This is a particularly serious consideration at the closer points where the differential between marine and air tariffs is currently small.

Bulk fuel tonnages reached a high in 1979 and then declined through 1980, 1981 and 1982, perhaps reflecting increased conservation and restraint. In 1983 and 1984 volumes started to increase again, as conservation savings had been achieved and by 1984 were back to 1978 levels. In 1985, there was a small drop from the 1984 levels, but demand was still 20-25 percent above the 1982/83 low period. In the 1984/85 period, the amount of bulk fuel delivered was equivalent to 3.9 tonnes per capita.

2.7 THE EASTERN ARCTIC SEALIFT

This section provides data for the Eastern Arctic Sealift on:

- o the schedule and level of service offered;
- o the tonnages carried.

2.7.1 Schedule and Level of Service

With the exception of Frobisher Bay and Pond Inlet which were each visited twice, each port in the supply area received one delivery of dry cargo in the 1984 season. Excluding bulk cargoes for DEW Line purposes, each community received only one delivery of bulk fuel.

Bulk fuel was carried in five different tankers with respective volumes of:

	12,600 tonnes
	2,900 tonnes
	5,600 tonnes
	7,200 tonnes
	<u>7,700 tonnes</u>
Total	36,000 tonnes

Dry cargo was carried in 13 vessel journeys, averaging 900 tonnes each as follows:

Area	Vessel	Tonnes
A Arctic Quebec	Federal Pioneer	10*
B Foxe Basin	Mesange	437*
C South Baffin	Mathilda Desgagnes	1,765
	Lady Franklin	2,058
	Lady Franklin	1,637
	Lady Franklin	87*
E East Baffin	Soodoc	2,441
F Mid/High Arctic	Terra Nordica	758
	Arctic Viking	22*
	Arctic Viking	845
	Ontadoc	1,068
G Thule	Fort Ramezay†	348
Total	Fort Ramezay†	497
		11,973

* Also carried non-Sealift cargo
 † A last-minute substitute vessel

The largest shipment was 2,441 tonnes for Cape Dorset, Lake Harbour and Pangnirtung. Since the vessels are allowed to load with private cargo for other ports once the Sealift cargoes have been loaded, some of the Sealift tonnages are relatively low. Assuming a normal tonnage of 1,000 tonnes per vessel, it appears that private shippers using the Federal Government Sealift may have consigned about 1,500 tonnes into Arctic Quebec and about 2,000 tonnes into Frobisher and the Mid/High Arctic.

The dates of arrival at the ports in each area varied between mid-July and normally mid-September as follows:

Area A:	Arctic Quebec	:	July 27 to October 15*
Area B:	Foxe Basin	:	August 30 to September 15
Area C:	South Baffin	:	July 26 to September 24
Area E:	East Baffin	:	August 20 to September 5
Area F:	Mid/High Arctic	:	July 14 to September 12
Area G:	Thule	:	July 23

* Engine trouble and bad weather.

2.7.2 Tonnages Carried

The total tonnage delivered by the Eastern Arctic Sealift in 1984 consisted of approximately 48,000 tonnes, divided into 36,000 tonnes of bulk fuel (75 percent) and 12,000 tonnes of dry cargo. The geographical destinations of the cargoes were:

Area	Principal Communities	Tonnes	
		Bulk	Dry Cargo
A Arctic Quebec	Sanikiluaq	0	447
B Foxe Basin*	Hall Beach, Igloolik, Repulse Bay	12,101	1,765
C South Baffin	Frobisher, Cape Dorset, Lake Harbour	6,347	6,223
E East Baffin	Clyde River, Broughton Island	6,301	758
F Mid/High Arctic	Resolute, Pond Inlet	4,926	2,283
G Thule	Thule**	0	497
O Outside	Newfoundland and Greenland	6,326	0
Total		36,001	11,973

* Includes cargo for Pelly Bay airlifted from Hall Beach.

** Cargo positioned for airlift to Alert.

Exhibit 2.9 shows the tonnages by community served. The deliveries of bulk fuel varied from 2.5 to 5.4 tonnes per capita, depending on location. Deliveries of dry cargo averaged 0.8 tonnes per capita. However, other shippers also consign cargo into these communities, either in federal Sealift or other vessels, as has been discussed, so that the overall tonnes per capita for each community will be higher.

2.8 MARINE CARGOES BY OTHER SHIPPERS

In addition to NTCL and the Eastern Arctic Sealift, there are six other shipping operations of interest:

- o the Hudson's Bay Company's own vessel MV Kanguk operating from Montreal;
- o the Moosonee Transportation Company's tug and barge operation out of Moosonee;
- o the Quebec Government Sealift operating out of Montreal;
- o Shell Oil Company which delivers bulk fuel out of Montreal;
- o other shippers using the Eastern Arctic Sealift vessels after federal cargoes have been loaded;
- o private charterers.

Discussions have been held with representatives of each of the above shipping operators. Estimates have been made of the tonnages shipped by each of the first five types of operator into the Study Area as follows:

Hudson's Bay Company	6,000 tonnes
Moosonee	8,500 tonnes
Quebec Sealift	3,000 tonnes
Shell Oil	54,000 tonnes
Others	3,500 tonnes

EXHIBIT 2.9

Eastern Arctic Sealift Deliveries
from Montreal - 1984

Community	Est. 1984 Population	Bulk Tonnes	Tonnes /Cap	Dry Cargo Tonnes	Tonnes /Cap
Hall Beach	399	1842	4.6	583	1.5
Igoolik	780	2714	3.5	361	0.5
Repulse Bay	382	945	2.5	323	0.8
Cape Dorset	861	2707	3.1	909	1.1
Lake Harbour	266	882	3.3	749	2.8
Frobisher	2904			3695	1.3
Pangnirtung	889	2758	3.1	870	1.0
Broughton Island	413	1881	4.6	205	0.5
Clyde River	500	1876	3.8	334	0.7
Nanisivik	279	1518	5.4	147	0.5
Arctic Bay	439	1203	2.7	130	0.3
Resolute	142			813	5.7
Grise Fiord	135	558	4.1	163	1.2
Pond Inlet	805	3165	3.9	906	1.1
Ungava	2170			155	0.1
East Hudson's Bay	2167			41	.0
Sanikiluaq	415			251	0.6
ShipsFuel, DEWLine		13952		624	
Total	13946	36001	3.6*	11259	0.8

* For communities served

SOURCE: Eastern Arctic Sealift Report 1984

In addition, private charters of vessels for single voyages by companies such as Cominco or Panarctic to support their mining/exploration sites are usually made out of Montreal but there are no available statistics on the cargo tonnages involved. Discussions with shippers in Montreal indicate that there are also voyages to Frobisher Bay by private operators shipping construction materials and general dry cargo. Specific information is not available on the tonnages involved or on the extent to which such cargoes are reshipped to other ports either by marine or air modes.

Exhibit 2.10 shows the estimates of marine tonnages by community, based on the known volumes of NTCL and Eastern Arctic Sealift cargoes by community and the overall estimated tonnages delivered by the other shippers. The amounts delivered by each shipper to each port are not public information and the values used in Exhibit 2.10 are estimates based on the known territories of operation of each shipper. However, it is believed that they are sufficient to permit conclusions to be drawn about the total consumptions of each port and generally how they are supplied. This analysis suggests that the communities generally receive about 4 tonnes of bulk fuel per capita and about 1.5 tonnes of dry cargo annually.

2.9 CHURCHILL RAILWAY TRAFFIC

Surface transportation to Churchill is provided by CN Rail. This carrier provides one freight train per week which leaves Winnipeg on Saturdays and arrives in Churchill on Mondays. In addition, a restricted piggy-back service is provided three times a week out of Thompson on specially equipped cars attached to the VIA passenger train.³

CN Rail shipments into Churchill are listed in Exhibit 2.11. The freight carried (exclusive of grain) while fluctuating significantly from year to year has been relatively constant during the past decade averaging close to 40,000 tonnes per year. In recent years the range was from 56,000

3. This is a modified Plan 2 service as it is restricted to one carrier, CN Route, the trucking subsidiary of CN Rail.

EXHIBIT 2.10
Marine Cargo - 1984
(tonnes)

BULK CARGO										MARINE DRY					
Dec84 Popn	Tons /cap	Tons	NTCL	EastArc Sealift	Shell Oil	Moos- onee	Tons /cap	Tons	NTCL	EastArc Sealift	Hudson Bay Co	Moos- onee	Quebec Sealift	Others	
KEEWATIN exc Repulse	4280	4.0	17074	17074	0	0	1.7	7424	7424	1267	1075				
Foxe&Repulse	1561	3.5	5501	5501			1.5	2342	1658	33					
Dorset&LkHarbour	1127	4.0	4508	3589	919		1.5	1691	1858	33					
Profisher	2904	4.5	13068		13068		1.9	5518	3695	823				1000	
East Ruffin	3602	4.1	14768				1.5	5403	3568	1835					
Ingava	2170	4.1	8897	12959			1.5	3255							
Hudson's Bay	2167	4.1	8885		8897		1.5	3251	155	850			1500	750	
James Bay	4623	4.1	18254		18254	700	1.5	6935	41	960		6935	1500	750	
Sanikiluaq	415	4.1	1701		1701		1.5	623							
FortSevern/Winisk	415	1.6	660			300	1.3	540	251	372		540			
Other				1452	466				624						
ShipsFuel & DEWLine	23264	4.0	94017	17074		1000	1.6	36979	7424	11259	5946	7475	3000	3500	
TOTAL															

Notes:

NTCL and Eastern Arctic Sealift Totals are from Published Data
Tonnes in Communities Not Served by NTCL, or EAS are estimated
on the basis of an assumed tonnes/capita
Totals in the "Others" columns are reconciled as follows:

Marine Bulk

1000 Moosonee

53000 Oil Company

54000 Total

Marine Dry :

7475 Moosonee

5946 HBC

3000 Quebec Sealift

3500 Others via Sealift

19921 Total

Notes: NTCL and Eastern Arctic Sealift Totals are from Published Data
Tonnages in Communities Not Served by NTCL, or EAS are estimated
on the basis of an assumed tonnes/capita
Totals in the "Others" columns are reconciled as follows:

Marine Bulk	1000	Moosonee	7475
Marine Dry	53000	HRC	5946
Oil Company	54000	Quebec Sealift	3000
Total		Others via Sealift	3500
		19921 Total	19921

EXHIBIT 2.11

RAILWAY TRAFFIC TO AND FROM CHURCHILL*
(000's Tonnes)

A) To Churchill	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
<u>Resupply and Local</u>										
Petroleum Products	21.3	23.5	18.8	15.4	22.7	42.6	35.3	21.4	32.6	44.4
General Freight	14.6	16.6	12.1	8.8	9.5	11.7	7.2	5.3	4.5	8.1
Freight Forwarders	0.8	1.5	1.8	2.6	1.7	2.1	2.1	2.8	2.6	3.2
Sub Totals	36.7	41.6	32.7	26.8	33.9	56.4	44.6	29.5	39.7	55.7
Other										
Grain Shipments	474.3	750.3	837.5	462.7	574.6	357.2	526.5	602.6	579.9	490.3
Miscellaneous	95.9	5.5	1.2	0.8	0.5	0.9	0.8	0.3	0.6	0.4
Sub Total	570.2	755.8	838.7	463.5	575.1	358.1	527.3	602.9	580.5	490.7
Total to Churchill	606.9	797.4	871.4	490.3	609.0	414.5	571.9	632.4	620.2	546.4
B) From Churchill										
Machines and Machinery	3.4	2.6	1.4	1.0	0.5	0.9	0.9	0.7	0.3	0.2
General Freight	4.9	6.4	7.6	1.1	1.3	5.0	4.9	1.0	1.5	9.1
Total From Churchill	8.3	9.0	9.0	2.1	1.8	5.9	5.8	1.7	1.8	9.3

*Excludes "CN Routes" traffic via truck to Thompson and via piggyback (TOFC) on VIA trains from Thompson to Churchill. Petroleum products include oil shipped in tankers and in drums.

Source: CN Commodity Report

tonnes in 1980 to 30,000 tonnes in 1982. Since 1982, freight increased steadily, registering 56,000 tonnes in 1984.⁴ In reviewing these values, it is necessary to bear in mind that they include the transport of goods to service both the local Churchill market and onward markets within the Keewatin district as well as a small volume destined to points within northern Manitoba.

For purposes of analysis, the freight traffic has been subdivided into two categories: bulk fluids and general dry freight. Included within the latter category are freight forwarder traffic, pool car traffic, petroleum products shipped in drums and other similar types of traffic.

Over the period 1975 to 1984, petroleum product shipments averaged 28,000 tonnes annually with a high of 44,000 tonnes in 1984 and a low of 15,000 tonnes in 1978.⁵ In comparison with the average year, shipments of petroleum products in 1984 were up by almost 60 percent to establish a record. This recent trend may be explained in part by a draw down in storage due to the fact that, starting in 1982, there was an apparent move to reduce the volume of inventory held at the Churchill tank farm and to move to a system where bulk fluids were brought into the centre more on a "as required" basis. There also could be variations in the quantities of fuel delivered dockside for vessel bunkering for which no statistics are available. There is a discrepancy in the statistics in that the railway statistics for petroleum products include an indeterminate tonnage of product shipped in drums. The NTCL statistics identify bulk fuel separately and petroleum products shipped in drums are classified as dry freight.

The policy of minimizing local inventory, has made annual fuel requirements at the Port far more responsive to changes in short term demand.

-
4. If CN Route Trucking trailers are included, the estimated tonnage carried was of the order of 62,400 tonnes.
 5. Offshore bulk oil shipments to Churchill by deep sea vessels were discontinued in the late 1970's.

The volume of general and freight forwarder traffic between 1975 and 1977 was extraordinarily high, probably reflecting the shipment of construction materials for the town centre complex in Churchill and the regional headquarters at Rankin Inlet. The volumes in 1982 and 1983 were low, reflecting the high use of air resupply at southern Keewatin points in these years, as discussed previously. However, in 1984 the volumes increased markedly to above the average 1978 - 1980 levels. General and freight forwarder traffic was 11,300 tonnes excluding CN Route trailer shipments. NTCL carried 7,400 tonnes to the Keewatin of which it is estimated approximately 1,000 tonnes was petroleum product in drums.

It is estimated that the air resupply into the study area from Churchill and Winnipeg direct was approximately 9,300 tonnes. The total cargo moved to Churchill by CN including CN Route trailers is approximately estimated to be:

<u>Petroleum Products</u>	Marine Resupply - Bulk	17,000
	Drums	<u>1,000</u>
		18,000
	Balance Churchill Port	<u>26,000</u>
	TOTAL	44,000
<u>Dry Goods</u>	Marine Resupply	7,400
	Less Drums	<u>1,000</u>
		6,400
	Air Resupply	9,000
	Churchill	<u>3,000</u>
		18,400

It is stressed that the above information is compiled from a number of different sources and a number of allocations are judgmental.

2.10 AIR TRAFFIC

Information on air cargo into the Keewatin from 1979 to 1982 is presented in a CTC report on the role of Churchill.⁶ The results of this

6. The Role of Churchill in the Transportation System for Northern Canada, Canadian Transport Commission Report No. 1983/03E, September 1983.

study have been updated to 1985 on certain assumptions and discussed below. Data on passengers and air cargo for the study area as a whole are then presented and analyzed.

2.10.1 Into the Keewatin

Exhibit 2.12 shows the data of the CTC report extended to the present by assuming that the total cargo demand (air plus marine) has been increasing uniformly in proportion to population increase. This shows an air demand accounting for about 48 percent of the dry cargo in 1979/80. As has been noted in Section 2.6.3 above, there was a higher proportion of air shipments in 1982/83 (this analysis suggests an air mode share of about 66 percent). This was subsequently reduced when government agencies made a deliberate effort to increase their marine shipments. In 1985 the air demand apparently accounts for about 55 percent of the cargoes.

It may be noted from this analysis that the total demand for dry cargo in the Keewatin by marine and air services combined is approximately 3.0 tonnes/capita.

2.10.2 Into The Study Area As A Whole

Data on air travel and freight in the study area is scarce and such data as are available are often intentionally unrevealing so as to keep individual airline information confidential.⁷ Exhibit 2.13 presents available unit toll data for airports in and adjacent to the study area of:

- o passenger utilization of each airport;
- o the number of passengers who are served by a Class 2 carrier for at least part of their journey;

7. Origin-destination volumes are reported by Statistics Canada only when the origin-destination pair is served by three or more airlines, so that any one of the three airlines would not be able to deduce the volumes carried by each of its competitors.

EXHIBIT 2.12

Air Cargo into the Keewatin (tonnes)

Year	Air	Marine	Total	% Air
1979	4809	6068	10877	44
1980	6200	6720	12920	48
1981	5900	5781	11681	51
1982	5989	3594	9583	62
1983*	7510	3890	11400	66
1984	9300	7424	16724	56
1985	6888	5712	12600	55

*Excluding Cullaton Lake Mines

Source: Air 79-82 CTC Report
Marine 79-85 NTCL
Total 83-85 IBI by trend

EXHIBIT 2.13 Unit Toll Air Traffic in Study Area and Adjacent (1984)

Community	1984 Estimated Population	Unit Toll Passengers	Passengers /Cap	Class 2 Passengers	Class 2 as % Unit Tl.	Class 2 Tnns. Dplnd.	In Air Study Area
Eskimo Point	1138	3614	3.2	210	6		Yes
Whale Cove	206	984	4.8				Yes
Rankin Inlet	1239	5576.*	4.5	1510	27		Yes
Chesterfield Inlet	251	1305	5.2				Yes
Baker Lake	1014	3994	3.9	510	13		Yes
Coral Harbour	432	1800	4.2				Yes
Hall Beach	399	5500	13.8	1690	31	207	Yes
Iqloolik	780	3120	4.0	1370	44		Yes
Repulse Bay	382	1300	3.4				Yes
Cape Dorset	861	3350	3.9	490	15		Yes
Lake Harbour	266	1809	6.8				
Grise Fiord	135	608.*	4.5				Yes
Resolute	142	11600	81.7	8740	75	294	Yes
Nanisivik & Arctic Bay	718	3080	4.3	3610	117	391	Yes
Pond Inlet	805	3771	4.7	550	15		Yes
Clyde River	500	2020	4.0	330	16		Yes
Broughton Island	413	1944	4.7	250	13		Yes
Pangnirtung	889	5856	6.6	720	12		
Frobisher	2904	44500	15.3	18800	42	1955	
Cambridge Bay	928	7300	7.9	3160	43	232	Yes
Gjoa Haven	647	2912.*	4.5				Yes
Spence Bay	454	1700	3.7				Yes
Pelly Bay	278	975	3.5				Yes
Total	16196	120351	7.4	41940	35	3079	
AIR STUDY AREA							
Resolute	142	11600	81.7	8740	75		
Balance	10239	45609	4.5	10270	23		
Total	10381	57209	5.5	19010	33		

* Estimated

SOURCE: Transport Canada
Statistics Canada

- o the amount of air cargo deplaned by a Class 2 carrier.

Passenger Travel

The propensity to travel by air in the study area is 4.5 trips per capita per year at communities excluding Resolute (clearly Resolute is an exception as a military base whose personnel are not in the population figures of the region and as a destination for air tours). The study area generates 45,600 passengers a year plus a further 11,600 to and from Resolute. Of these passengers, 10,300 receive service at some part of their journey by a Class 2 carrier, plus a further 8,700 to and from Resolute. Probably this Class 2 service is either supplied by Nordair to and from Montreal or Pacific Western Airlines to and from Edmonton.

Unit Toll Air Cargo

Based on the CTC Keewatin air cargo analysis, referred to above, the study area with a population of 10,381 would be expected to generate 15,600 tonnes of air cargo (at 1.5 tonnes per capita). Of this total, 4,700 tonnes (or 30 percent) would be expected to be carried by unit toll carriers.

The data of Exhibit 2.13 are consistent with such a generation rate. They show 3,080 tonnes deplaned in or adjacent to the area of Class 2 carriers. Much of these tonnages will then be carried on into the study area by lower level carriers. In addition, 1,400 tonnes (or 30 percent of the estimated 4,600 tonnes by air into the Keewatin) would be expected to have been taken into the Keewatin by Class 2 or 3 unit toll carriers. Northwest Territorial will also have taken cargo from Edmonton, Yellowknife and Winnipeg into the study area. Part of this will be in the Keewatin total, but cargo for East Kitikmeot and Baffin will have been taken either directly by them, or deplaned for further delivery by another carrier (e.g. in Rankin Inlet for on-going charter shipment by Keewatin Air).

Hence cargo by unit toll carriers into the study area is estimated at 4,700 tonnes a year, originating as follows:

Montreal/Toronto	2,700
Winnipeg/Churchill	1,000
Edmonton/Yellowknife	<u>1,000</u>
	4,700

Charter Air Cargo

Based on the CTC estimated ratio that 70 percent of total air cargo is carried by charter services, the study area would be expected to generate 10,900 tonnes of charter air cargo. It is known that Pacific Western Airlines flies scheduled DEW line related charters from Winnipeg to Hall Beach and Cambridge Bay. Nordair also operates charters from Montreal in association with its contracted DEW Line resupply service across the Arctic, passing through the study area on a line from Cambridge Bay to Hall Beach to Frobisher. However, volumes from each of the origins are not known.

The combined volume estimate of 15,600 tonnes of air cargo (unit toll + charter), equivalent to 1.5 tonnes per capita, is confirmed later in Chapter 4, where Aviation Statistics Centre data for 1984 shows 20,000-24,000 tonnes delivered to the 16,000 persons living in and adjacent to the study area. However, a high proportion of the cargo in 1984 is first lifted into, or close to the study area by a unit toll carrier. About 60 percent is subsequently transferred to a charter operation or a small unit toll carrier.

2.11 TRAFFIC PROJECTIONS

Future tonnage demands in the Eastern Arctic can be expected to vary closely with the number of people in the region. Fuel is required for heating and travel; while savings due to conservation were achieved in the

early 1980's, it is believed that the bulk of such savings have been attained. A growth in proportion to population increase is now expected. Dry cargo, which includes non-perishable food and construction supplies is also expected to vary with population size and growth. There is still a backlog of housing demand and more construction is anticipated even for a static population - more if population grows. This chapter therefore presents:

- o a population projection for the communities in the study area;
- o a tonnage projection based on the population projections.

2.11.1 Population Projection

Historically, the mid-Arctic communities have been growing at a rate of 3-1/2 percent to 4 percent per year due to natural increase and to immigration. Individual communities have grown faster than this, due to mining activity in resource communities and to increased government activity, e.g. by the government of the Northwest Territories in decentralizing services to Rankin Inlet.

At the present time, there are no major new mining or energy developments foreseen. Canterra is operating a drill ship in Hudson Bay which could lead to increased oil exploration depending on drilling results, but there is no evidence yet of a major expansion. Although there are many known mineral reserves, for example in the Baker Lake area, most mining prospects are dormant. The possible separation of the Northwest Territories into two entities may lead to a further decentralization of government into the Keewatin, but there is no assurance of this. Increased tourism into the area is foreseen and the Territorial Government is promoting this to increase employment.

The Bureau of Statistics of the Government of the Northwest Territories publishes a "baseline" forecast, which projects population in each community on the basis of natural increase. Actual populations may be higher than the baseline values if there is increased industry and government activity. On the other hand, if the new industry does not develop or if tourism does not expand to the extent hoped for, it is possible that there could be net emigration leading to population levels below those of the "baseline" forecast.

For the purposes of this study, we have adopted the "baseline" forecast, being lower than the previous trend although not as low as the trend could become if development is stalled for a sustained period of time. Officials in the Government of the Northwest Territories suggested this was an appropriate, conservative approach, an opinion shared by the Study Team. However, sensitivity to this assumption is tested by examining what might be the impact for example of a new mine.

The baseline forecast of population is shown in Exhibit 2.14. It represents a growth rate of about 2.7 percent p.a. over the 1984-1989 period in most of the existing and potential communities in the Churchill resupply area and about 2.3 percent p.a. over the twenty-year period 1984-2004.

2.12.2 Tonnage Projection

Using the values of 4.0 tonnes per capita for the bulk fuel and 1.5 tonnes per capita for the dry cargo, the marine tonnage projections corresponding to the population projections of Exhibit 2.14 are shown in Exhibit 2.15. Total marine cargo demand in the Keewatin area would amount to about 27,000 tonnes in 1989 and by 2004 about 37,000 tonnes.

If the NTCL territory were expanded to include Foxe Basin, Hudson Strait and/or the east side of Hudson Bay, NCTL's total marine resupply tonnages in 1989 and 2004 would be:

EXHIBIT 2.14

POPULATION PROJECTIONS

Community	1981	1984	-----POPULATION-----*				84-	84-
	Cens	Estd	-----PROJECTIONS-----*				89	04
	Popn	Popn	1989	1994	1999	2004	* %pa	%pa
Eskimo Point	1022	1138	1301	1468	1664	1862	*2.71	2.49
Whale Cove	188	206	234	263	289	312	*2.58	2.10
Rankin Inlet	1109	1239	1411	1577	1710	1872	*2.63	2.08
Chesterfield Inlet	249	251	290	335	381	427	*2.93	2.69
Baker Lake	954	1014	1159	1313	1418	1557	*2.71	2.17
Coral Harbour	429	432	490	556	625	698	*2.55	2.43
KEEWATIN(excRepulse)	3951	4280	4885	5512	6087	6728	*2.68	2.29
Hall Beach	349	399	452	515	589	658	*2.53	2.53
Igloolik	746	780	881	1009	1131	1267	*2.47	2.46
Repulse Bay	352	382	436	496	562	622	*2.68	2.47
FOXEBASIN(incReplse)	1447	1561	1769	2020	2282	2547	*2.53	2.48
Cape Dorset	784	861	989	1124	1227	1335	*2.81	2.22
Lake Harbour	252	266	304	342	381	419	*2.71	2.30
HUDSON STRAIT	1036	1127	1293	1466	1608	1754	*2.79	2.24
Grise Fiord	106	135	164	182	200	212	*3.97	2.28
Resolute	168	142	159	177	195	212	*2.29	2.02
Nanisivik	261	279	318	354	405	440	*2.63	2.31
Arctic Bay	375	439	500	557	638	693	*2.63	2.31
Pond Inlet	705	805	917	1022	1170	1271	*2.63	2.31
Clyde River	442	500	569	635	727	789	*2.63	2.31
NORTH BAFFIN	2057	2300	2626	2927	3335	3618	*2.69	2.29
Gjoa Haven	523	647	730	833	941	1051	*2.44	2.46
Spence Bay	431	454	510	572	639	697	*2.35	2.17
Pelly Bay	257	278	309	345	381	414	*2.14	2.01
EAST KITIKMEOT	1211	1379	1549	1750	1961	2162	*2.35	2.27
Ungava	1987	2170	2479	2818	3132	3435	*2.69	2.32
EastHudsonsBay	1984	2167	2475	2814	3128	3431	*2.69	2.32
James Bay	4232	4623	5280	6004	6673	7319	*2.69	2.32
Sanikiluaq	383	415	474	539	599	657	*2.69	2.32
EAST SIDE	8586	9375	10708	12176	13532	14842	*2.69	2.32
FTSEVERN/WINISK	420	415	415	415	415	415	*0.00	0.00
TOTAL	18708	20437	23245	26266	29219	32065	*2.61	2.28
MARINE STUDY AREA	15440	16758	19069	21589	23923	26285		
AIR STUDY AREA	9450	10381	11818	13333	14891	16389		

SOURCES:

Bureau of Statistics GNWT - Oct 85 Projections
Fort Severn/Winisk Report
IBI Projection of East Side at Arctic rate

EXHIBIT 2.15

MARINE CARGO PROJECTIONS (tonnes)

Community	BULK					DRY					TOTAL (Bulk & Dry)				
	1989	1994	1999	2004	-----PROJECTIONS-----	1989	1994	1999	2004	-----PROJECTIONS-----	1989	1994	1999	2004	-----PROJECTIONS-----
Eskimo Point	5204	5872	6656	7448		1952	2202	2496	2793		7156	8074	9152	10241	
Whale Cove	936	1052	1156	1248		351	395	434	468		1287	1447	1590	1716	
Rankin Inlet	5644	6308	6840	7488		2117	2366	2565	2808		7761	8674	9405	10296	
Chesterfield Inlet	1160	1340	1524	1708		435	503	572	641		1595	1843	2096	2349	
Baker Lake	4636	5252	5672	6228		1739	1970	2127	2336		6375	7222	7799	8564	
Coral Harbour	1960	2224	2500	2792		735	834	938	1047		2695	3058	3438	3839	
KEMANIN	19540	22048	24348	26912		7328	8268	9131	10092		26868	30316	33479	37004	
Hall Beach	1808	2060	2356	2632		678	773	884	987		2486	2833	3240	3619	
Iglolik	3524	4036	4524	5068		1322	1514	1697	1901		4846	5550	6221	6969	
Repulse Bay	1744	1984	2248	2488		654	744	843	933		2398	2728	3091	3421	
FOX BASIN	7076	8080	9128	10188		2654	3030	3423	3821		9730	11110	12551	14009	
Cape Dorset	3956	4496	4908	5340		1484	1686	1841	2003		5440	6182	6749	7343	
Lake Harbour	1216	1368	1524	1676		456	513	572	629		1672	1881	2096	2305	
HUDSONSTRAIT	5172	5864	6432	7016		1940	2199	2412	2631		7112	8063	8844	9647	
Ungava	9914	11274	12528	13742		3718	4228	4698	5153		13632	15501	17227	18895	
EastthadsonBay	9900	11258	12511	13723		3713	4222	4692	5146		13613	15480	17203	18869	
James Bay	21121	24017	26691	29275		7920	9006	10009	10978		29041	33024	36700	40254	
Senikiluaq	1896	2156	2396	2628		711	809	899	986		2607	2965	3295	3614	
EAST SIDE	42831	48705	54127	59367		16062	18264	20297	22263		58893	66969	74424	81630	
FISHERY/WINISK	664	664	664	664		540	540	540	540		1204	1204	1204	1204	
TOTAL	75283	85361	94699	104147		28522	32301	35802	39346		103805	117662	130501	143493	

SOURCE IBI Projections Based on Population Projections
and tonnage per capita estimates

	<u>1989</u>	<u>2004</u>
Keewatin plus Foxe Basin	36,600	51,000
Keewatin plus Hudson Strait	34,000	46,600
Keewatin plus the East Side	86,000	118,600

3. MARINE AND RAIL RESUPPLY

As noted in Section 1.3, the basic methodology used in this report has been to identify possible changes to transportation systems or operations which will reduce costs as necessary to favour cargo routings through Churchill, assuming satisfactory levels of service.

The first section of this chapter provides estimates of goods movement rates from origin to destination on a comparable basis. To facilitate such comparisons, subsequent sections evaluate opportunities to route more marine traffic through Churchill, either by extending NTCL services or by making it attractive for vessels presently operating from Montreal to use Churchill as the source for some of their deliveries. The chapter concludes with a summary of opportunities which appear to offer cost-effective marine routings through Churchill for shippers under certain conditions. A lower road/rail tariff from Winnipeg to Churchill is a key component in inducing additional traffic and its importance is assessed. The opportunities associated with achieving more favourable rates are evaluated in more detail in Chapter 6.

3.1 TRANSPORTATION RATES

To develop comparable transportation rates, this chapter presents marine and land rates to various destinations from the major Canadian locations where the required products originate - e.g. dry cargoes from Montreal or Winnipeg or bulk fuel from a Montreal or an Edmonton refinery. It also puts the rates on a comparable basis where the method of charging or the level of service differ.

The sections below present the rate information as follows:

- o adjustments to allow for differences in the basis of charging,
- o adjusted marine rates from port of origin;
- o land rates from major centres to respective ports.

3.1.1 Differences in Basis of Charging

Marine transportation rates quoted by NTCL or by the Eastern Arctic Sealift differ in three different respects:

- o NTCL charges firm rates negotiated year by year between Transport Canada and NTCL while Sealift rates are tendered each year and are more variable and unpredictable;
- o NTCL charges for dry cargo primarily by weight but the Sealift charges by a combination of weight and volume measurements;
- o NTCL delivers dry cargo to the consignee's location whereas the Sealift delivers only to the high water mark in the destination port.

These differences are discussed below. In addition, adjustments to published Sealift costs are discussed to allow for insurance costs and fuel used by the delivering tanker.

Variation in Rates

Because the Sealift costs are variable, this analysis has used the average rate for each area averaged over the five years 1980 to 1984 as a basis to compare Sealift rates. There appears to have been no significant trend in rates through this period, the middle year of 1982 being generally the highest. The table below shows how different the highest and lowest quoted rates were from the average of the five years.

	<u>Highest Rate Exceeded the Average By</u>	<u>Year of Highest Rate</u>	<u>Lowest Rate Was Below the Average By</u>	<u>Year of Lowest Rate</u>
A. Quebec	29%	1982	19%	1980
B. Foxe Basin	13%	1982	26%	1980
C. Hudson Strait	10%	1982	9%	1980
E. East Baffin	15%	1983	9%	1981
F. Mid-High Arctic	7%	1982	9%	1983
G. Thule (Alert Airlift)	41%	1984	21%	1981

Method of Computing Tonnage

NTCL charges primarily on the basis of tonnes weight. Sealift charges customers on a "cargo-tonne" basis. A cargo-tonne is equal to the greater of:

- o the tonnes weight;
- o the cubic metres of volume divided by 2.5.

For example, at a rate of \$250/tonne, the shipper would pay \$250/tonne by weight or \$100/cu.m whichever was higher. On average over the last five years, the average charges paid on a cargo-tonne rate basis have been 1.65 times as high as would have been the case if the shipment had been paid for on a weight basis.

For this report, Sealift dry cargo rates have been converted to rates per tonne weight. The adjustment has been made for each geographical area, by revising the rate levied on those cargoes charged on a volume basis to what the rate would have been on a weight basis.

Level of Service

Since Sealift delivers only to the high water mark, a charge of \$80/tonne has been added to allow for transfer of goods from the beach to the consignee's location. Such a charge should vary by customer and by port, but an average value of approximately \$80 is considered appropriate and conservative. This part of the operation is relatively time-consuming (the NTCL tug and barges spend about 15 percent of their time unloading dry cargo) and is expensive, particularly if trained crews have to be flown in, as is the practice of NTCL.

Adjustments To Quoted Sealift Bulk Fuel Costs

The contracted per diem costs of the specific Sealift fuel tankers used in 1984 are shown in Appendix E, together with information on the

sailing times, days in port and geographical areas served by each tanker. An estimate of vessel fuel costs and insurance is then made to determine total chartering costs of each vessel. Based on this analysis, the following estimates are made of bulk fuel delivery costs to each area:

	<u>\$/Tonne</u>
B. Foxe Basin	105
C. Hudson Strait	80
E. East Baffin	110
F. Mid-High Arctic	116
G. Thule	80

3.1.2 Adjusted Marine Rates

After the adjustments and revisions proposed in the previous sub-section, the per tonne weight costs of the NTCL (1985 rates) and Sealift deliveries (1980-84 average charges including an additional allowance for local delivery) may be compared as follows:

	<u>Bulk Fuel</u>	<u>Dry Cargo</u>	<u>75% Bulk +25% Dry</u>
NTCL - Keewatin	116	399	187
Sealift - A - Arctic Quebec	110*	574	226
- B - Foxe Basin	105	528	211
- C - Hudson Strait	80	381	155
- E - East Baffin	110	587	229
- F - Mid/High Arctic	116	515	216
- G - Thule	80	385	156

* No Sealift deliveries made, but this estimate is based on comparisons with nearby similar areas.

It is apparent that the prices charged by NTCL are not markedly different from those presently paid to the Sealift for services to communities in the Foxe Basin or Hudson Strait. NTCL rates are about \$24/tonne less than Sealift rates to the Foxe Basin; they are about \$32/tonne more than Sealift rates to Hudson Strait.

It should be noted that the rates do not generate sufficient revenues to repay costs fully in either service. NTCL receives a subsidy which varies from year to year and in the period 1978-1983 averaged about 20 percent of revenues. However, there was reported to be no subsidy in the last two years and the need for subsidy is expected to remain low or disappear if cargo volumes remain at 1984 levels or higher. The Sealift is not formally subsidized, but the consignees pay only the direct shipping cost with no allowance for the administration cost of the Canadian Coast Guard. This could amount to 10 percent - 20 percent of system costs.

3.1.3 Land Rates from Major Centres

Dry cargoes into Churchill or Moosonee are transported by rail or road from centres such as Winnipeg or Toronto, unless sources for some commodities can be found nearer to the port (such as lumber from Cochrane). Cargoes shipped from Montreal can, however, normally be sourced from close to the port.¹

Bulk fuel cargoes similarly have to be transported by rail to Churchill or Moosonee from refineries in Edmonton or Southern Ontario, whereas vessels loading in Montreal are served from local refineries.

It is reasonable to assume that dry cargoes can be purchased generally for approximately the same price in Winnipeg as in Montreal and that both are basic low-cost sources. The Inter-city Indices of Retail Price Differentials (Statistics Canada 62-010) for the latest available date (September 1984) are as follows:

1. None of the supply centres are completely self-sufficient. The necessary east-west interchange however takes place in the south rather than the north because the southern system is cheaper to use though distances are longer.

	<u>Edmon- ton</u>	<u>Regina</u>	<u>Winni- peg</u>	<u>Toronto</u>	<u>Mont- real</u>
Food purchased from stores	103	103	95	104	97
Household operations, furnishings	97	109	94	103	97
Personal care supplies & equipment	95	100	96	102	99
Recreation, reading & education	97	99	96	103	97
Tobacco and alcohol	93	103	101	101	101

It was assumed that goods routed through Churchill will, on average, have to bear a mark-up reflecting the land cost of transport from Winnipeg to Churchill. Similarly cargoes through Moosonee will start from a centre further south such as Toronto. Individual items, such as a ski-doo will have to come from further than Winnipeg, but equally some Montreal goods will come from Western Canada.

The land transportation components associated with these additional transfers are discussed below:

Dry Cargo From Winnipeg to Churchill

The rail rate from Winnipeg to Churchill for general merchandise is \$123 per tonne (\$5.60 per 100 lbs.) if shipped in a boxcar with an 18.2 tonnes (40,000 lbs.) minimum weight. Some individual shippers may not be in a position to ship in such a quantity. The cost for less than car load quantities is \$212 per tonne (\$9.60 per 100 lbs.). Even large shippers such as Hudson's Bay Company report that the average cost of the service is close to \$9.00 per 100 lbs. after consolidation and pooling in Winnipeg.

There is a proposal to interest a company in Winnipeg to consolidate shipments for each Keewatin destination into 13.7m (45 ft.) trailers with 20 tonne minimum loads for shipment to the port of Churchill or to Churchill airport. The trailers would be driven to Thompson, Manitoba and then loaded onto flatcars for delivery in Churchill and then directly onto the NTCL barge to the Keewatin. The proposed charge would be \$123/tonne (\$5.60 per 100 lbs.) for this service. It is at present in a discussion stage.

Dry Cargo from Southern Ontario to Moosonee

Items such as lumber, when shipped in carload quantities from Toronto, with a 18.2 tonne (40,000 lbs.) minimum, pay:

	<u>\$/tonne</u>
Toronto - Cochrane	96.80
Cochrane - Moosonee	<u>35.90</u>
	132.70

Bulk Fuel From Edmonton to Churchill

Bulk fuel is produced in Edmonton, shipped part way by pipeline (usually to Regina) and then transported by rail to Churchill. For this combination of transshipment points the rail charges are estimated to be about \$82 per tonne.² The cost to ship crude oil from Edmonton to Montreal by pipeline, however, is only \$3/tonne. Hence, Montreal starts with a differential advantage of about \$79/tonne in comparison with Churchill assuming equal refining costs at Edmonton and Montreal.

However, the actual cost of fuel in Churchill as bid by the oil company does not reflect the full \$79/tonne differential transportation costs relative to Montreal. The Government of the Northwest Territories buys fuel in both centres and in 1985 paid prices as follows:

	<u>ex-Churchill</u>	<u>ex-Montreal</u>
<u>cents per litre</u>		
P50	33.5	27.9
Gasoline	32.45	28.7

2. In 1985 freight revenues to CN from resupply oil delivered by NTCL were approximately \$1.3 million of which approximately \$0.15 million appears to have been absorbed by the oil company.

\$ per tonne

Average bulk fuel	420	352
(90% P50-10% gasoline)		

The difference between Churchill and Montreal prices is therefore \$68/tonne, indicating that the oil company absorbed some of the transportation cost to Churchill in computing its bid.

Since NTCL charge \$116/tonne for bulk fuel delivery from Churchill, a customer would be able to obtain his fuel more cheaply from Montreal provided the Sealift cost was less than \$184/tonne. As noted on page 3-4, however, Sealift delivery costs are everywhere less than or equal to \$116/tonne. That leads to the conclusion that Churchill is uncompetitive with Montreal as a source for Arctic resupply unless Churchill can obtain offshore fuel stocks by ocean tanker at near Montreal prices. This possibility is discussed further in later sections.

3.2 EXPANSION OF NTCL SERVICES

The present NTCL service to the Keewatin in an average year utilizes the existing fleet from July 17 to October 4. Since the Port is generally open until late October, there is some scope for route expansion with the existing fleet by operating over an extended season. In the sections below, the elapsed service time requirements are evaluated for each of the adjacent areas of Foxe Basin, Hudson Strait, the east side of Hudson Bay and the Ontario coast.

The suitability of the NTCL equipment for each of the areas is also assessed, taking into account ice, wind and port access conditions. Costs of the NTCL service and those of the competing Sealift system are compared and conclusions are drawn as to requirements for operation modifications by NTCL for it to compete for the cargoes presently delivered by the Sealift.

3.2.1 Capacity of NTCL System to Expand

The normal NTCL season consists of nine journeys from Churchill (with 11 or 12 stops, through combining cargoes to more than one destination on a particular trip) each with an average round trip of nine days, yielding an 81 day season from July 17 to October 4. A journey typically transports up to 3,000 tonnes of dry and bulk fuel cargoes combined.

The potential new destinations within the economic range of the NTCL tug and barge system would, with present per capita cargo generation rates, add the following volumes:

Foxe Basin	8,600 tonnes
Cape Dorset/Lake Harbour	6,200 tonnes
East side of Hudson Bay	51,600 tonnes
Fort Severn/Winisk	1,200 tonnes

Service to the Foxe Basin would require three journeys and Cape Dorset/Lake Harbour two journeys. The east side of Hudson Bay in total far exceeds NTCL's capacity. However Sanikiluaq, the nearest point (and part of the Northwest Territories, other than Quebec) would add 2,300 tonnes which could be handled in one journey.

Foxe Basin

The following discussion assumes that future investigations by NTCL determine that their equipment can operate effectively in the Foxe Basin. Servicing of this area would require one journey to Repulse Bay, one to Igloolik and one to Hall Beach and Longstaff Bluff. (A further trip to Hall Beach would be required if the DEW Line fuel requirements also were to be met). Assuming a sailing speed from Churchill of 7 knots, the round trip times would be:

	<u>Round-Trip naut. miles</u>	<u>Round-Trip Sailing (days)</u>
Repulse Bay	1,000	6
Igloolik	1,700	10
Hall Beach/Longstaff	1,820	11

With existing methods, this additional work would require 40 calendar days, taking the season through to November 13 which is too late unless icebreaker support were available. However, by streamlining the loading and unloading operations of NTCL (e.g. by containerization, a greater use of piggyback trailers, by providing fixed dock facilities at some outports, or by arranging for the local communities to transfer cargoes from the high water mark after departure of the barge), and possibly reducing the time at Churchill to an average of 1/2 day from the present average of one day and unloading at the destination ports to 1-1/2 days from 2-1/2 days. The elapsed times then required would be as follows:

	Present NTCL Season	With Foxe Basin and Present Methods	With Foxe Basin and Streamlined Services
Number of journeys	9	12	12
Number of stops	11	15	15
Time at Churchill	9 days	12 days	6 days
Round-trip sailing	45 days	72 days	72 days
Unloading	27 days	37 days	22 days
Season length	81 days	121 days	100 days

The extra 19 days with the streamlined services would extend the season from October 4 to October 23. Normally, NTCL is prepared to operate until October 15 if cargoes are available; the required season extension would therefore be a further eight days which would be possible but allows no contingency for weather delays or equipment breakdown.

A possible method of reducing the extended season by a week would be to add a third barge on some journeys and to construct a wharf at Rankin Inlet. When serving Foxe Basin it would be possible for the tug to start initially with three barges; this would reduce its speed from 7 knots to perhaps 6 knots. It would then drop a barge at Rankin wharf and carry on with two barges into Foxe Basin.

The saving of one trip to Rankin Inlet for every two trips to Foxe Basin (offset by some increase in sailing time) would just about save the required days.

Alternatively, assuming that the season can be extended to October 23 in most years, it might be possible to schedule cargoes so that the least essential are left till last (e.g. bulk fuel over and above the amount required for the following winter season). Or points with low second trip dry cargo volumes only could be left to the last and if necessary be served by air.

Hudson Strait

To serve this area would require two journeys, one to Cape Dorset and a second to Lake Harbour with an intermediate stop at Cape Dorset. The sailing time would be:

	Round-Trip naut. miles	Round-Trip Sailing Time (days)
Cape Dorset	1,000	6
Lake Harbour/Cape Dorset	1,520	9

Without any change in loading or unloading practices, the normal season to serve Keewatin and Hudson Strait would be:

No. of journeys	11
No. of stops	14
Load at Churchill	11 days
Round-trip travel	60 days
Unload	35
	<u>106 days</u>

This would require a season extension of 25 days to October 29th.

If loading at Churchill could be reduced by half of a day and the unloading could be reduced to 1-1/2 days from 2-1/2 days, then the required season would be:

Load at Churchill	6 days
Round-trip travel	60 days
Unload	21 days
Total	<u>87 days</u>

This would take six days longer than the present season implying a normal season of July 17 to October 10. This would be feasible.

If an attempt were made to serve Keewatin, together with both Foxe Basin and Hudson Strait, then even with reduced loading and unloading time as postulated above the timing requirements would be:

No. of journeys	14
No. of stops	18
Load at Churchill	7 days
Round-trip travel	87 days
Unload	27 days
Total	<u>121 days</u>

This would take 40 days longer than at present, implying a normal season completion on November 13. This date would be marginally acceptable at Churchill but would not leave adequate contingency at the resupply ports, particularly at those where icebreaker support is impractical because of limited draft and navigation space.

If Cape Dorset and Lake Harbour were added to the service, it might be possible also to add Repulse Bay which would extend the season to October 16th. It might be possible to serve Repulse Bay by way of Ross Welcome Sound, thereby avoiding the Foxe Basin.

Sanikiluaq

Sanikiluaq would require one additional journey of about 1,000 miles round trip, implying about ten more days of activity using present practices, which is within NTCL's present planned season closure of October 15. If Foxe Basin, Hudson Strait and Sanikiluaq were all added with no change in practice the required season length would be:

No. of journeys	16
No. of stops	21
Load at Churchill	16 days
Round-trip travel	95 days
Unload	52 days
Total	163 days

This would provide about double the present volume of work and would therefore support two tugs and the associated barges. However, as will be seen later, there are limited opportunities to make NTCL expansion competitive with service from Montreal, even when assuming NTCL's marginal costs as the full cost of the existing service. The cost of adding a new tug and barges for a 3 month season would clearly be prohibitive in comparison with Montreal-based service unless the equipment were seagoing and other uses for it could be found during the Churchill off-season.

3.2.2 Ice, Weather and Port Access Conditions

NTCL has a single, relatively large tug (3375 HP) which, while not conforming to a standard ice classification, it has some capability in ice. However it has to restrict its territory to appropriate waters since, if the vessel were locked in for any significant period of time, or if it

were damaged, it would jeopardize the supply of materials to the basic Keewatin ports. For this reason, it is considered by the NTCL and the study team that the Foxe Basin and the port of Fort Severn (shallow available draft) are not suitable destinations at this time.

The Foxe Basin ports are liable to wind-blown ice at all times of the year and there is no month when the NTCL tug and barges could enter with confidence. A more detailed assessment of ice conditions based on first hand information from vessels operating in the area would be required to resolve differences of opinion which currently exist between mariners on the practicability of tug and barge operations in the Basin. Furthermore, the practicability of accessing Repulse Bay from the south through Roes Welcome Sound (to the west of Southampton Island), should be determined.

Access to Fort Severn in Ontario is through a narrow channel. It is the judgement of the team that Fort Severn service would be more suitable for tugs such as those owned by Moosonee Transportation Co. Ltd. and in fact Moosonee Transportation Co. has commenced service there.

3.2.3 Cost Comparisons

The price of oil in Churchill is \$68 per tonne higher than it is in Montreal. Dry cargo can be carried from Winnipeg to Churchill for \$123/tonne in carload quantities. If NTCL could absorb these additional costs, through improved productivity, it would be in a good position to compete in adjacent Sealift ports.

To examine whether this would be possible, consider the cargo for Cape Dorset and Lake Harbour in Hudson Strait.

The components of cargo for delivery there consists of:

- o 4,510 tonnes bulk fuel

- o 1,690 tonnes dry cargo

At the average rates of the Sealift (plus an allowance for shore handling), the customers would pay \$80/tonne for bulk and \$381/tonne-weight for dry cargo, leading to a total cost of \$1,004,690.

If these cargoes were routed via Churchill and NTCL, the additional cost of fuel in Churchill (at \$68/tonne) would be \$306,680. The additional cost of transporting dry cargo from Winnipeg to Churchill (at \$123 tonne) would be \$207,870. For NTCL to be able to absorb these costs and match Sealift costs, it would have to transport the cargoes to Cape Dorset and Lake Harbour for \$490,140.

NTCL estimate that the marginal cost to them of an additional trip to Cape Dorset, including a contribution to overhead and profit would be \$144,000 (or \$16,000 per day, since a 9-day trip is required). The additional costs to Lake Harbour calculated on the same basis, would be \$256,000 for a 16 day round trip. The combined cost for the two trips to Cape Dorset and Lake Harbour would therefore be \$400,000 which is \$90,000 below the costs of the Sealift with shore landing. Therefore there appears to be a case for expanding NTCL's territory to Hudson Strait, despite the higher cost of supplies at Churchill, provided that mechanisms can be found to permit the opportunity to be attractive to Cape Dorset and Lake Harbour residents, perhaps through some form of marginal cost pricing for the marine service.

A similar calculation shows that NTCL can competently supply Sanikiluaq assuming recovery of marginal costs only; the savings would exceed the additional costs of bulk fuel and dry cargo at Churchill.

3.3 USE OF CHURCHILL BY SEALIFT OR OTHER RESUPPLY VESSELS

The Sealift organizes its bulk fuel deliveries in tankers and its dry cargoes in contracted Canadian vessels. Either type of vessel could,

after delivering its initial load to one Arctic region (such as Hudson Strait) proceed to Churchill for reloading and deliver a subsequent cargo to another region (such as Foxe Basin). The Hudson's Bay Company are interested in operating in such as fashion. These opportunities are discussed below.

3.3.1 Bulk Fuel Vessels

A tanker used by the Eastern Arctic Sealift costs approximately \$21,000 a day to own and operate, including insurance costs and the cost of consumed fuel. Typically it carries about 7,200 tonnes and requires about 8 days to sail from Montreal to the entrance of Hudson Bay near Cape Dorset and a further 2 days from that point into Churchill.

If a tanker were to service the ports of Hudson Strait, for example, and then reload at Churchill to serve Foxe Basin destinations, it would save 12 days in comparison with a return to Montreal. These 12 days would be worth \$250,000 or \$35 per tonne. Since fuel is \$68 per tonne more expensive in Churchill than at Montreal (an incremental cost of approximately \$490,000 a load), it is not economical to use Churchill at current fuel prices. For Churchill fuel resupply to be economic, it would be necessary to locate an off-shore source of refined product which could be delivered to Churchill in relatively small quantities (17,000 tonnes maximum with present facilities) for a price not more than \$35/tonne above the Montreal price. This may be achievable, given that prior to 1978 Churchill oil supplies for the military installations were primarily delivered by tanker in 17,000 tonne shipments (the last 17,000 tonne shipment arrived in 1978 from Aruba).

3.3.2 Dry Cargo Vessels

The opportunity cost of a dry cargo vessel of the types used in the Eastern Arctic Sealift clearly differs from vessel to vessel and from season to season. A value of \$7,000 a day including fuel and insurance is

a reasonable estimate when there are other competing opportunities available, although on some occasions the vessel owner might well be willing to accept less.

If such a vessel were to use Churchill to reload after delivering its first Sealift cargo, it would save 12 days of sailing time, or \$84,000 by not having to return to Montreal. Since the additional cost of transporting the cargo from Winnipeg to Churchill via CN is at least \$123 per tonne, the dry cargo vessel would make a net saving by using Churchill only if the volumes to be transported from there were less than 680 tonnes; for cargoes above this tonnage, it would be worth returning to Montreal. In 1984, the average size of Sealift cargoes was approximately 1,000 tonnes, so that this opportunity does not appear economic given the CN tariffs currently in effect.

However, if the land transfer cost from Winnipeg to Churchill were reduced sufficiently, the opportunity could become economic. Moreover, in future, vessel costs may increase to above \$7,000 a day. Hence Exhibit 3.1 shows the land transportation rate that has to be achieved for a vessel to break-even with a return to Montreal. For present vessel costs of \$7,000 per day and shipment sizes of 1,000 tonnes, the required land transportation cost is \$84.00 per tonne. A similar rate would be required for \$10,000 per day vessels and 1,500 tonne shipments.

Both the Hudson's Bay Company and Arctic Cooperatives Limited have indicated an interest in shipping out of Churchill on east coast originating vessels, because there are advantages to them in using traditional suppliers in Manitoba. The Hudson's Bay Company could make an additional trip with their own vessel in a season and reduce their need for chartering. A rate of \$80 per tonne for cargo from Winnipeg to Churchill would make the opportunity to use Churchill attractive to them.

EXHIBIT 3.1

RATE COMPARISON FOR CHURCHILL AS A SECONDARY SEALIFT RESUPPLY BASE

Required Winnipeg-Churchill Land Transportation
Rate for Vessels to Prefer Churchill to a
Montreal Return

Vessel Cost (\$/day)	(\$/tonne)			
	TONNES PER VESSEL			
	1000	1500	2000	2500
7000	84	56	42	34
10000	120	80	60	48
15000	180	120	90	72

SOURCE: Computation based on a 12-day Saving
in Round-Trip Travel Time

3.4 CONCLUSIONS ON MARINE TRAFFIC

There appear to be two major types of opportunity to increase the use of the Port of Churchill for marine deliveries: (1) an extension of NTCL services; and (2) use of Churchill by east coast-based vessels after an initial voyage to supply an area such as Arctic Quebec. These are overlapping opportunities in that any extension of NTCL services (e.g. into Hudson Strait) reduces the opportunity for east coast-based vessel resupply. A further minor opportunity is for NTCL to be permitted to charge on a sliding scale related to distance to enable it to recapture some traffic in the Southern Keewatin from the air mode.

3.4.1 Extension Of NTCL Services

The most promising opportunity to extend NTCL services is into Hudson Strait. It is a logical extension from Coral Harbour and the navigational conditions are suitable for NTCL equipment. The additional volume of 6,200 tonnes initially (comprising 4,500 tonnes fuel and 1,700 tonnes dry cargo) would require two additional trips, increasing to three as traffic increases with population growth. With measures to increase productivity, such as the use of a dock at Rankin Inlet, and the use of local resources to move cargo from the high water mark at major locations, this additional tonnage could be handled with the existing equipment and crews. NTCL would have to be permitted to charge lower rates based on marginal costing if the new communities are to maintain the present landed cost of goods, particularly bulk fuel.

Foxe Basin and Fort Severn/Winisk are not considered suitable destinations for NTCL at this time given the navigational conditions: ice and wind in the former and a narrow channel in Fort Severn. The supply of Repulse Bay by way of Roes Welcome Sound is a possibility provided that safe navigation procedures can be established. It would be technically feasible for NTCL to serve a portion of Arctic Quebec, but the potential shippers there have close affiliations with Montreal, whereas customers in

the Northwest Territories, such as Arctic Cooperatives Limited have expressed a preference for Churchill as a supply point.

3.4.2 Attraction Of East Coast-Based Vessels To Use Churchill

For a Sealift or Hudson's Bay Company vessel based on the east coast or in Montreal, a potential itinerary would be:

- o Trip 1 - Montreal to Arctic Quebec to Churchill;
- o Trip 2 - Churchill to Foxe Basin to Churchill;
- o Trip 3 - Churchill to Hudson Strait to Churchill;
- o Trip 4 - Churchill to Frobisher to Montreal;
- o Trip 5 - Montreal to East Baffin to Montreal as required.

This would attract to Churchill approximately 10,000 tonnes of new dry cargo as follows:

- o Sealift to Foxe Basin, 2,300 tonnes;
- o Sealift to Hudson Strait, 1,700 tonnes;
- o Sealift to Frobisher, 2,000 tonnes;
- o Hudson's Bay's Vessel, 4,000 tonnes.

This additional tonnage would increase to about 11,700 tonnes by 1989 and 15,000 tonnes by the end of the century based on projected population growth.

An essential condition for this opportunity to materialize, is a reduced tariff on the land transportation link from Winnipeg to Churchill to a level of about \$80-\$90 per tonne.

Finally, if NTCL were permitted to charge a sliding scale so that the marine/air tariff ratio in the South Keewatin approaches that in the North, marine tonnes/capita in the South could be expected to increase to 1.5. This increase would not require an additional trip to the southern communities but would improve the productivity and cost recovery of the NTCL operation.

3.5 A LOWER COST LAND LINK FROM WINNIPEG TO CHURCHILL

The requirement for transporting goods by surface mode between Winnipeg and Churchill differs from that between most other cities in Canada in that Churchill is accessible overland only by rail. It is unique in that Churchill is also a port. The normal policy of CN is to encourage piggyback transportation between major urban centres only. They have offered the piggyback service between Winnipeg and Churchill via Thompson in exchange for the discontinuation of a refrigerated car service. The piggyback service directly out of Winnipeg is offered only by Costa Cartage who have to use time-consuming and expensive methods to fasten trailers to standard flat cars; the railway's policy is not to provide special piggyback type cars.

To achieve a lower cost land link from Winnipeg to Churchill requires the introduction of a system which is not in accord with the policy of the railway for that line. However, if significant new cargoes via Churchill can be developed by reorganizing the Eastern Arctic Sealift to deliver some cargoes out of Churchill by reaching an understanding with the Hudson's Bay Company, Arctic Cooperatives Limited and the Northwest Territorial Government to ship via Churchill (as the companies wish to do) assuming an appropriate rail service and cost, then the volumes might be sufficient to cause the railway to change its policy.

An Eastern Arctic Sealift review in fiscal 1985/86 is considering the possibility of the Nunasi Corporation operating the Sealift from fiscal 1987/88 onwards. Given the Nunasi ownership of NTCL, this offers the

opportunity of an evaluation of Churchill routings being included in the Sealift process and the negotiation of appropriate rates for these cargoes on the railway.

Exhibit 3.2 shows the costs of shipping trailers by various routes within Manitoba and for comparable distances on B.C. Rail, which unlike CN promotes the use of trailers on non inter-urban routes. The rate from Winnipeg to Churchill is about \$120 per tonne. In contrast, a rail haul of the same distance from North Vancouver to Fort Nelson on B.C. Rail costs \$1805 for a 13.1m (45') trailer with a load to 20.87 tonnes (46,000 lbs.) - or \$1615 if a 11.6m (40') trailer is used. The former tariff amounts to \$90 per tonne with a 20 tonne cargo; the latter tariff for 20-tonne 11.6m trailers is approximately \$80 per tonne.

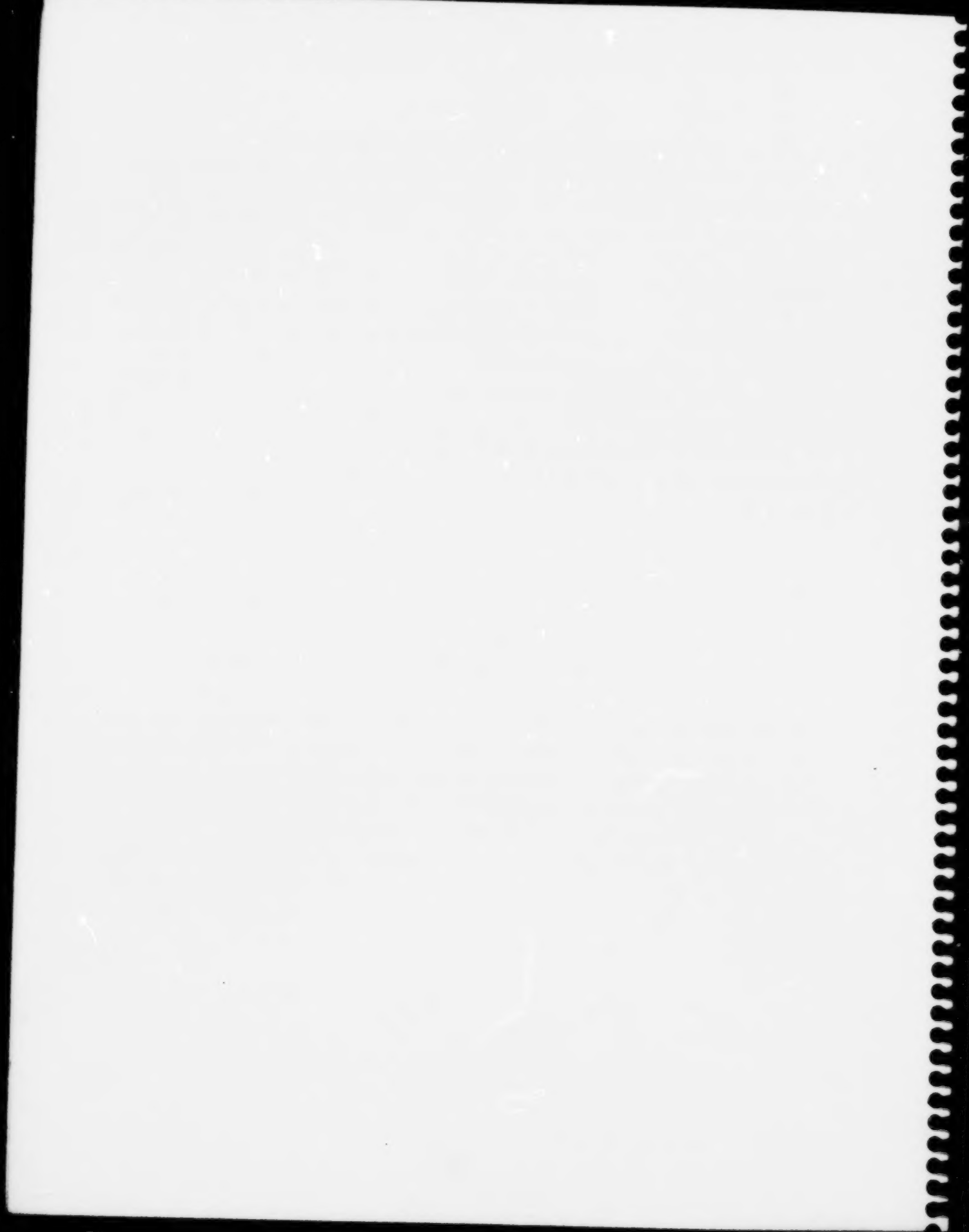
The justification for a tariff at this level (or perhaps lower for higher volumes) is confirmed by a trucker serving Gillam, Manitoba, who estimates a rate of \$113 per tonne for a trailer load to Churchill if there were a road. Since quantity rail rates are generally lower than road rates, a road/rail tariff in the \$80-90/tonne range may be achievable.

In comparison, B.C. Rail charge a rate of only \$30/tonne for the 775 km distance from Vancouver to Prince George; this would convert to \$61/tonne for Winnipeg to Churchill on a tonne-mile basis. The B.C. Rail rate reflects the ability of Prince George to offer significant volumes of back haul traffic which would not be available to the same extent at Churchill. Hence a rate approaching the \$90/tonne charged for the Fort Nelson traffic might be the more appropriate target tariff for the Winnipeg-Thompson-Churchill road/rail link.

EXHIBIT 3.2

TRAILER RATES FOR VARIOUS ROUTES AND DISTANCES

		Km	\$/Tonne	Comments
Winnipeg to Thompson	CN Truck Tariff	760	71	45000 lbs
Winnipeg to Gillam	Private Trucker	1000	88	45000 lbs
Winnipeg to Churchill	CN Rail	1574	123	Full Boxcar
Winnipeg to Churchill	CN Route Via Thompson	1574	121	40000 lbs
Winnipeg to Churchill	Via Consolidator	1574	200	Small Shipments
Winnipeg to Churchill	CN Rail LTL	1574	212	Small Shipments
N. Vancouver to Pr. George	B.C. Rail	775	30	46000 lbs
N. Vancouver to Ft. Nelson	B.C. Rail	1576	90	46000 lbs
Winnipeg to Churchill	Trucker's Estimate (assuming a road)	1310	113	46000 lbs



4. AIR RESUPPLY

The air and marine resupply operations into the study area are partially complementary in that they are primarily used by the same shippers and both rely heavily on CN and local forwarders to deliver cargo at Churchill. The sections below discuss:

- o the amounts of passengers and cargo to and from the study area;
- o the rates and level of service;
- o the opportunities and constraints on traffic movements north from Winnipeg and Churchill.

Data on the present flows of passengers and air cargoes, supplied on a confidential basis by the Aviation Statistic Centre (ASC) have been reviewed. The specific data cannot be made public because they reveal the volumes transported by individual carriers. However, summary numbers and total traffic by routes have been quoted in a broad way and in such a fashion that carrier privacy is respected.

4.1 PASSENGER AND CARGO AMOUNTS

Exhibit 2.13 has shown that there are about 130,000 two-way unit toll passengers handled at airports in and adjacent to the study area. The five largest volumes are at:

Frobisher	44,500
Rankin Inlet	16,700
Resolute	11,900
Hall Beach	7,700
Cambridge bay	7,300

Based on the ASC data, approximately 80 percent of the total passenger traffic is unit toll. In total, therefore, about 160,000 passen-

gers are handled annually at airports in and adjacent to the study area. Passenger origin-destination statistics are available only for passengers carried on Class 1 and some Class 2 services, so that it is not known how many of the remaining passengers are travelling wholly within the area, and how many are travelling across its boundaries to or from major centres in Southern Canada. The corridor volumes associated with the 110,000 passengers on flights which originate or terminate in a Southern centre are distributed as follows:

<u>Flights which include:</u>	<u>Percent</u>
Montreal/Ottawa	55
Edmonton/Yellowknife	15
Winnipeg/Churchill	30

Air cargo flows into the communities on the same three corridors - from Montreal/Ottawa in the East, from Edmonton/Yellowknife in the West and from Winnipeg/Churchill in the South. Cargo from the East is principally delivered by unit toll aircraft, which deplane the cargo at Frobisher, Resolute and Hall Beach. From these locations it is redistributed to small communities by a combination of unit toll and charter services.

From the West, cargo is delivered by unit toll aircraft to Cambridge Bay, Resolute, Rankin Inlet and Frobisher. The volume of this traffic is relatively low and there is little redistribution from these centres.

From the South, primarily unit toll aircraft deliver cargo to Keewatin from Churchill, Thompson and Winnipeg. There is little redistribution - most of this cargo is taken unit toll to its destination. Additionally, there are periodic DEW line related charter flights from Winnipeg to Hall Beach.

In total, it is estimated that about 20,000-24,000 tonnes of cargo is flown into the communities in and adjacent to the study area.

This represents 1.5 tonnes per capita and confirms the earlier analyses, which had deduced that marine traffic was about 1.5 tonnes per capita and that the modal split marine/air was approximately 50/50.

Of this quantity slightly over 10,000 tonnes originates in the East or West (very heavily from the East) and approximately 9,500 tonnes originates from Winnipeg/Thompson/Churchill in the South. Most of the air cargo shipped from Churchill arrives there by rail from Winnipeg or by road from Winnipeg to Thompson and then by piggyback rail from Thompson to Churchill.

The ratio of passengers to cargo varies markedly in the three corridors. The number of passengers per tonne of cargo is:

<u>Route from the:</u>	<u>Passengers/tonne¹</u>
East	5
South	2
West	20

(It should be noted that passengers are two-way but cargo is largely in-bound to the area).

These differences in traffic composition are reflected in the east-west operations' being largely passenger services, and those from the East being combie services carrying both freight and passengers in the passenger cabin simultaneously. Operations from the South incorporate both combie services by small aircraft and a high proportion of flights by unit toll cargo only aircraft.

The reasons for these differences are partly explained in the analysis of rates and levels of service, as described below.

1. The corresponding average ratio for all unit toll services operating in the area excepting PWA to Churchill is 5.2 passengers per tonne of cargo.

4.2 RATES AND LEVEL OF SERVICE

The geographic locations of the communities and connecting airline distances to major centres are shown in Exhibit 4.1 and their community structure is shown in Exhibit 4.2. The available unit toll airline services based on 1985 official schedules are shown in Exhibit 4.3.

The principal flows of unit toll air passengers and cargo between Manitoba and the Arctic are along the Winnipeg/Rankin Inlet transportation corridor. This north-south corridor approximately bisects that region of the arctic which at all points is closer to Winnipeg than to the major competing resupply centres of Edmonton to the west and Montreal to the east. Theoretically, the unit air toll passenger and cargo tariffs for services between this region and Winnipeg should be lower than those between the same points and either of the competing centres. In practice, because of the existing route structure this is not the case except for the centres within the Keewatin region already linked to Winnipeg.

It is evident from the route structure map of Exhibit 2.6 that points north of Keewatin are well-connected by air service to Montreal and to Edmonton by Class 1 and 2 carriers but less well-connected to Churchill or Winnipeg. The superior network, particularly to the East, results in lower passenger air fares and better service to more distant eastern centres than to nearer southern ones, as is discussed further below. It is estimated that for the locally bound carriers the current ratio of passenger revenues to cargo revenues is approximately 40/60. The proportion of passenger revenues for Calm Air would be less than this because passengers from Winnipeg to Rankin Inlet can bypass Churchill on the direct NWT service and thus are not available to Calm Air, thereby reducing passenger revenues. At the same time cargo arriving by rail at Churchill is more readily available to Calm Air than to the other carriers, thereby increasing Calm Air cargo revenues.

LOCATION OF SELECTED ARCTIC COMMUNITIES

COMMUNITY	REGION	LOCATION LAT. °N LONG. °W	DISTANCE AIR km TO
Arctic Bay	Baffin	73 02' 85 10'	1223 NM/Frobisher Bay 1674 NE/Yellowknife
Baker Lake	Keewatin	64 19' 96 02'	257 NM/Rankin Inlet 946 NE/Yellowknife 626 NM/Churchill
Bathurst Inlet	Kitikmeot	66 50' 108 02'	175 S/Cambridge Bay 579 NE/Yellowknife
Broughton Island	Baffin	67 33' 64 02'	428 N/Frobisher Bay 2373 NE/Yellowknife
Cambridge Bay	Kitikmeot	69 07' 105 03'	960 NE/Yellowknife
Cape Dorset	Baffin	64 14' 76 32'	402 SM/Frobisher Bay
Chesterfield Inlet	Keewatin	63 20' 90 42'	101 NE/Rankin Inlet 576 N/Churchill
Clyde River	Baffin	70 28' 68 36'	740 N/Frobisher 2153 NE/Yellowknife
Coppermine	Kitikmeot	67 50' 115 06'	595 N/Yellowknife 1603 N/Edmonton
Coral Harbour	Keewatin	64 08' 83 10'	720 W/Frobisher Bay 1560 NE/Yellowknife 830 NE/Churchill
Eskimo Point	Keewatin	61 07' 94 04'	241 SM/Rankin Inlet 1080 E/Yellowknife 264 N/Churchill
Frobisher Bay	Baffin	63 45' 68 31'	2261 E/Yellowknife 2060 N/Montreal
Gjos Haven	Kitikmeot	68 38' 95 52'	142 SM/Spence Bay 1056 NE/Yellowknife
Grise Fiord	Baffin	76 25' 82 54'	383 NE/Resolute 3931 NE/Yellowknife
Hall Beach	Baffin	68 46' 81 13'	840 NM/Frobisher Bay 1650 NE/Yellowknife

COMMUNITY	REGION	LOCATION LAT. °N LONG. °W	DISTANCE AIR km TO
Holman	Kitikmeot	70 44' 117 45'	507 NM/Cambridge Bay 925 N/Yellowknife
Iqloolik	Baffin	69 23' 81 48'	362 NE/Repulse Bay 1641 NE/Yellowknife
Lake Harbour	Baffin	62 51' 69 53'	12 S/Frobisher Bay 2245 NM/Yellowknife
Nanisivik	Baffin	73 02' 84 33'	27 W/Arctic Bay 1280 SE/Frobisher Bay
Pangnirtung	Baffin	66 09' 65 43'	298 N/Frobisher Bay 2333 N/Yellowknife
Pelly Bay	Kitikmeot	68 32' 89 49'	177 SE/Spence Bay 1312 NE/Yellowknife
Pond Inlet	Baffin	72 42' 77 59'	525 SE/Resolute 1883 NE/Yellowknife
Rankin Inlet	Keewatin	62 49' 92 05'	475 N/Churchill 1088 E/Yellowknife
Repulse Bay	Keewatin	66 32' 86 15'	1424 NM/Yellowknife 954 N/Churchill
Resolute Bay	Baffin	74 42' 94 50'	1561 NE/Yellowknife 3444 NM/Montreal
Sachs Harbour	Inuvik	71 59' 125 14'	1159 NM/Yellowknife
Sanikiluaq	Baffin	56 32' 79 14'	1024 SM/Frobisher Bay 1282 NM/Montreal
Spence Bay	Kitikmeot	69 32' 93 31'	1224 NE/Yellowknife
Tuktoyaktuk	Inuvik	69 27' 133 02'	137 N/Inuvik 1130 NM/Yellowknife
Whale Cove	Keewatin	62 10' 92 36'	80 S/Rankin Inlet 386 N/Churchill
Yellowknife	Headquarters	62 27' 114 22'	960 N/Edmonton 1088 W/Rankin Inlet

EXHIBIT 4.2

COMMUNITY STRUCTURE
SELECTED ARCTIC COMMUNITIES

COMMUNITY	REGION	STATUS	POPULATION 1981	POPULATION 1976	INUIT %	DENE %	OTHER %
Arctic Bay	Inuvik	Hamlet	375	391	94		6
Baker Lake	Keewatin	Hamlet	954	863	89		11
Bathurst Inlet	Kitikmeot				100		-
Broughton Island	Baffin	No settlement Council	80	39			4
Cambridge Bay	Kitikmeot	Hamlet	378	354	96		25
Cape Dorset	Baffin	Hamlet	815	616	75		5
Chesterfield Inlet	Keewatin	Hamlet	784	888	95		6
Clyde River	Baffin	Hamlet	249	243	94		2
Coppermine	Kitikmeot	Hamlet	443	352	98		7
Coral Harbour	Keewatin	Hamlet	809	750	93		5
Eskimo Point	Keewatin	Hamlet	429	414	93		36
Frobisher Bay	Keewatin	Hamlet	1,022	848	95	1	5
Gjoa Haven	Baffin	Town	2,333	2,320	63		10
Grise Fiord	Kitikmeot	Hamlet	523	420	95		3
Hall Beach	Baffin	Settlement	106	121	90		8
Holman	Baffin	Hamlet	349	287	97		5
Igloodik	Kitikmeot	Hamlet	300	264	92		69
Inuvik	Baffin	Hamlet	746	675	95		8
Lake Harbour	Inuvik	Town	3,147	3,116	21	10	5
Nanisivik	Baffin	Hamlet	252	235	92		60
Pangnirtung	Baffin	No settlement Council	261	not indicated	40		5
Pelly Bay	Baffin	Hamlet	1,022	807	95		6
Pond Inlet	Kitikmeot	Hamlet	257	246	94		6
Rankin Inlet	Baffin	Hamlet	705	504	94		22
Repulse Bay	Keewatin	Hamlet	1,109	852	77	1	3
Resolute	Keewatin	Hamlet	352	265	97		9
Sachs Harbour	Baffin	Settlement	168	223	91	3	6
Sanikiluaq	Inuvik	Settlement	101	163	91		4
Spence Bay	Baffin	Hamlet	383	300	96		8
Tuktoyaktuk	Kitikmeot	Hamlet	431	443	92		10
Whale Cove	Inuvik	Hamlet	772	590	88	2	8
Yellowknife	Keewatin	Hamlet	188	179	92		8
	Headquarters	City	9,483	8,256	1	8	91

Source: NWT Data Book 1984/85

EXHIBIT 4.3
AIR TRANSPORTATION SERVICES
CHURCHILL RESUPPLY AREA

COMMUNITY	OPERATOR	AIRCRAFT TYPES	ORIGIN	TRANSIT POINTS*	FARES (one way-economy)	SERVICE FREQUENCY
BAKER LAKE (YBK)	Calm Air (MD)	HS7	Churchill (YYQ)		293.	Mon.(2), Wed.(2), Fri.
	(MD)	HS7	Eskimo Point (YEK)	1	203.	Mon.(2), Wed.
	(MD)	DHT, HS7	Rankin Inlet (YRT)	1	172.	Mon.(2), Tues, Wed., Thurs., Fri., Mon.
CHESTERFIELD INLET (YCS)	(MD)	HS7	Thompson, Man. (YTH)	3	-	
CHURCHILL (YYQ)	(MD)	HS7	Baker Lake (YBK)	1	95.	
	(MD)	HS7	Coral Harbour (YZS)	0	293.	Mon.(2), Tues., Med.(2), Fri.
	(MD)	HS7	Eskimo Point (YEK)	1	364.	Thurs.
	Pacific Western Airlines (PW)	735	Gillam, Man. (TGA)	0	165.	Mon., Tues., Wed., Fri.
	(MD)	HS7	Rankin Inlet (YRT)	0	78.	Mon., Med., Fri.
	(MD)	HS7	Repulse Bay (YUT)	2	242.	Mon., Tues.(2), Med., Thurs.(2), Fri.
	(MD)	HS7	Thompson, Man. (YTH)	2	413.	Tues., Thurs.
	(PW)	735	Winnipeg, Man. (YWG)	0	-	Mon.
CLYDE RIVER (YCY)	First Air	HS7	Broughton (YWN)	1	192.	Mon., Med., Fri.
	(7F)	HS7	Frobisher Bay (YFB)	1	158.	Mon., Med.
	(7F)	HS7	Pond Inlet (YIO)	1	269.	Mon., Med.
CORAL HARBOUR (YZS)	(MD)	HS7	Churchill (YYQ)	1	158.	Tues., Thurs.
	(7F)	HS7	Cape Dorset (VTE)	0	364.	Tues.
	(7F)	HS7	Frobisher Bay (YFB)	1	138.	Fri.
	(MD)	HS7	Rankin Inlet (YRT)	0	248.	Fri.
ESKIMO POINT (YEK)	(MD)	HS7	Repulse Bay (YUT)	0	234.	Tues.
	(MD)	HS7	Baker Lake (YBK)	1	174.	Thurs.
	(MD)	HS7 DHT	Churchill (YYQ)	0	203.	Mon., Tues., Med., Fri.
	(MD)	HS7 DHT	Rankin Inlet (YRT)	1	165.	Mon.(2), Med., Fri.
GRISE FIORO	Kann Borek Air	(4K)	Thompson, Man. (YTH)	1	145.	Mon., Tues., Thurs., Fri.
NALL BEACH (YUX)	Nordair	(ND)	Resolute	0	190.	Mon.
	(NV)	73M	Montreal (YUL)	2	180.	Med., Sat.
	(NV)	73M	Cambridge Bay (YCB)	3	509.	Med.
	(MD)	73M	Ft. Chimo, Quebec (YCP)	1	614.	Med., Sat.
	(NV)	D3M	Frobisher Bay (YFB)	0	331.	Med., Sat.
	(7F)	DHT	Gjoa Haven (YHK)	2	223.	Med.
	(7F)	D3M	Igloolik (YGT)	0	335.	Med.
	(7F)	DHT	Pelly Bay (YBB)	0	67.	Mon., Med.(2), Sat.(2)
	(7F)	DHT	Pond Inlet (YIO)	1	139.	Med.(2)
	(7F)	DHT	Repulse Bay (YUT)	1	183.	Mon.
	(NV)	D3M	Spence Bay (YYH)	1	136.	Med.
	(NV)	LOM D3M	Yellowknife (YZF)	3	263.	Med.
IGLOOLIK (YGT)	(7F)	DHT	Nanisivik (YSR)	2	682.	Med.
	(7F)	DHT	Hall Beach (YUX)	0	196.	Mon.
	(7F)	DHT	Nanisivik (YSR)	0	67.	Mon., Med.(2), Sat.(2)
PELLEY BAY (YBB)	(7F)	DHT	Pond Inlet (YIO)	1	157.	Mon.
	(NV)	D3M	Cambridge Bay (YCB)	0	146.	Mon.
	(NV)	D3M	Coppermine (YCO)	2	486.	Mon., Med.
	(MD) (NV)	D3M	Frobisher Bay (YFB)	0	710.	Mon.
	(NV)	D3M	Gjoa Haven (YHK)	1	-	Med.
	(NV) (7F)	D3M DHT	Hall Beach (YUX)	0	196.	Mon., Med.
	(MD) (NV)	D3M 73M	Montreal (YUL)	2	139.	Med.(2)
	(7F)	DHT	Repulse Bay (YUT)	0	599.	Med.
	(NV)	D3M	Spence Bay (YYH)	0	118.	Med.
POND INLET (YIO)	(NV)	D3M	Yellowknife (YZF)	4	124.	Mon., Med.
	(7F)	HS7	Broughton (YWN)	1	647.	Mon., Med.
	(7F)	HS7	Clyde River (YCY)	0	287.	Mon., Med.
	(7F)	HS7	Frobisher Bay (YFB)	2	162.	Mon., Med.
	(7F)	DHT	Hall Beach (YUX)	1	357.	Mon., Med.
	(7F)	DHT	Igloolik (YGT)	0	183.	Mon.
RANKIN INLET (YRT)	(MD)	DHT	Nanisivik	0	146.	Mon.
	(MD)	HS7 DHT	Churchill (YYQ)	2	106.	Mon.
	(MD)	HS7	Baker Lake (YBK)	1	242.	Mon.(2), Tues., Med., Thurs., Fri.
	(NV) (PW)	LOM 735	Coral Harbour (YZS)	0	172.	Mon., Tues.(2), Med., Thurs., Fri.(2)
	(MD)	HS7 DHT	Edmonton (YED)	2	234.	Thurs.
	(NV)	LOM	Eskimo Point (YEK)	1	-	Tues.(2), Thurs., Fri.
	(MD)	HS7	Frobisher Bay (YFB)	0	145.	Mon.(2), Fri.
	(MD)	HS7	Repulse Bay (YUT)	1	427.	Tues., Thurs.
	(NV)	LOM	Thompson (YTH)	2	-	Tues., Thurs.
	(NV)	LOM	Winnipeg (YWG)	0	-	Mon.
REPULSE BAY (YUT)	(NV)	LOM	Yellowknife (YZF)	0	430.	Tues., Thurs.
	(MD)	HS7	Churchill (YYQ)	0	408.	Tues.(2), Thurs., Fri.
	(7F)	DHT	Hall Beach (YUX)	2	413.	Tues., Thurs.
	(7F)	DHT	Pelly Bay (YBB)	1	136.	Med.
	(MD)	HS7	Rankin Inlet (YRT)	0	119.	Med.
RESOLUTE BAY (YRB)	(PW)	73M	Edmonton (YEG)	1	242.	Tues., Thurs.
	(MD)	73M	Frobisher Bay (YFB)	1	438.	Med., Sat.
	(MD)	DHT	Montreal (YUL)	1	363.	Tues., Fri.
	(4K)	DHT	Nanisivik (YSR)	0	642.	Tues., Fri.
	(4K)	DHT	Pond Inlet (YIO)	1	186.	Thurs.
	(PW)	73M	Yellowknife (YZF)	0	270.	Thurs.
SPENCE BAY (YYH)	(NV)	D3M	Cambridge Bay (YCB)	1	286.	Med., Sat.
	(NV)	D3M	Coppermine (YCO)	2	396.	Mon., Tues., Med., Thurs., Fri.
	(NV) (MD)	D3M 73M	Frobisher Bay (YFB)	1	552.	Mon.
	(NV)	D3M	Gjoa Haven (YHK)	0	-	Med.
	(NV)	D3M	Hall Beach (YUX)	1	96.	Mon., Med., Thurs., Fri.
	(NV) (MD)	D3M 73M	Montreal (YUL)	2	263.	Med.
	(NV)	D3M	Pelly Bay (YBB)	0	-	Med.
WHALE COVE	(NV)	LOM D3M	Yellowknife (YZF)	1	124.	Med.
	(MD)	DHT	Churchill	0	558.	Mon., Med., Fri.

* Minimum transits sometimes exceeded.

Aircraft Type Legend

725 - Boeing 727-200
 735 - Boeing 737-200/200C & 300 series
 73M - Boeing 737-200 Mixed Passenger/Freighter
 DHT - de Havilland of Canada DHC8 Twin Otter
 D3M - McDonnell Douglas DC3/Dakota C47
 D95 - McDonnell Douglas DC9/30, 40, 50 & 80 series
 HS7 - Hawker Siddley 748 (all series)
 LOM - Lockheed Electra L100 Mixed Configuration

Source: Official Airline Guide.

4.2.1 Passenger Fares and Levels of Service

In order to determine the practicability of extending the Churchill air resupply area it is useful to examine the level of service available to potential traffic zones.

Hall Beach lies in the middle of the study area and would be a logical hub for an extended Winnipeg-north air service intended to capture traffic which is nearer to Winnipeg and Churchill than to other centres. The fares and the frequencies of service from Hall Beach are as follows:

<u>Destin- ation</u>	<u>Distance (Nautical Miles)</u>	<u>Routing</u>	<u>One-Way Fare (\$)</u>	<u>\$/N.M.</u>
Montreal	1564	Nordair with two stops (Wed/Sat)	509	0.33
Edmonton	1563	NWT* with four stops (Wed)	682	0.44
Winnipeg	1293	First Air to Repulse Bay (Wed) Calm Air to Rankin Inlet (Tue/Thurs) NWT to Winnipeg (Tue/Thurs)	808	0.62
Churchill	726	First Air to Repulse (Wed) Calm Air to Churchill (Tue/Thurs)	620	0.86

* Northwest Territorial Airlines

The lack of direct service north from Winnipeg (Winnipeg to Rankin Inlet excepted) means that fares in this corridor are the sum of a number of segments, with no reduction for cumulative distance. This results in relatively high prices for a lower level of service.²

The distance from Hall Beach to Churchill is 46 percent of the distance of Hall Beach to Montreal, but the trip costs 22 percent more and

2. The higher costs on the Northern routes are partly attributable to the utilization of less efficient aircraft and partly to higher basing costs. It is estimated that it would cost 15 to 20 percent more to base a B737 aircraft in Yellowknife than in Winnipeg. The corresponding figure for Churchill is estimated at between 25 and 30 percent.

requires an overnight stop in Rankin Inlet. A round-trip from Hall Beach to Churchill takes a week compared with four days to Montreal. Admittedly, the level of traffic demand between Hall Beach and Churchill is low, but the same relative situation applies for traffic to Winnipeg where demand is greater.

Therefore, while a resident of Hall Beach lives closer to Winnipeg on the basis of cost, he is less likely to travel there than to Montreal. Since unit toll cargo tariffs tend to be linked with passenger tariffs, Montreal and Edmonton will generally be favored over Winnipeg as unit toll cargo shipping points and hence as the major sources of supplies. There may also be an indirect link between routings of unit toll and charter cargoes. Most unit toll carriers also operate charters and sometimes use the same aircraft for both services so that the unit toll route structures can also significantly influence the charter cargo routings.

The lower rates to Montreal and Edmonton occur because the airlines operating out of those major centres have built up their traffic to the point where they can use larger aircraft and offer tapered fares (i.e. the fare from Montreal to Hall Beach is less than the combination of the fares from Montreal to Frobisher and from Frobisher to Hall Beach). However, from Winnipeg north (with the exception of travel to Rankin Inlet on Tuesday and Thursday), travel involves transferring from airline to airline sometimes, with overnight stop-overs and no tapered fares.

The one-way fares for various other routes in the area (in unit toll cents per nautical mile³) are as follows:

3. In this chapter distances expressed in nautical miles are those obtained from the Air Navigation charts for designated air routes. In most cases they exceed the straight line distance between the centres shown.

<u>Route</u>	<u>Carrier</u>	<u>\$/n.m.</u>
Montreal to Frobisher Bay	Nordair	\$0.39
Frobisher Bay to Hall Beach	Nordair	0.58
Pelly Bay to Gjoa Haven	NWT	1.35
Yellowknife to Edmonton	NWT	0.35
Rankin Inlet to Churchill	Calm Air	0.94
Churchill to Winnipeg	PWA	0.36
Rankin Inlet to Winnipeg	NWT	0.52

Unit toll fares generally are from \$0.30 to \$0.50 per nautical mile along the main routes of Class 1 and Class 2 carriers between major centres (such as Edmonton-Yellowknife or Montreal-Frobisher Bay) rising to \$0.80 to \$1.40 per nautical mile at the periphery (e.g. Frobisher Bay to Broughton Island or Cambridge to Gjoa Haven). The Eastern corridor has more Class 2 links served by larger aircraft and the costs per unit distance are therefore relatively lower throughout.

Any extension of the present Winnipeg corridor further to the North will result in head on competition between the new carrier and the existing carriers who already operate efficient aircraft. However the shorter distance to Winnipeg, and passenger preferences could offset this advantage.

4.2.2 Cargo Rates and Level of Service

Air cargo enters the region primarily as unit toll cargo but much of the redistribution is carried out by charter flights. It is estimated that of the 24,000 tonnes carried into the area, about 14,000 tonnes is redistributed from the initial point of deplanement. The principal carriers who enter the region receive cargo revenues varying between \$0.80 and \$1.50 per tonne-km; redistribution costs between \$2 and \$5 per tonne-km.

The market area served by Winnipeg/Churchill consists primarily of the Keewatin, together with some small penetration north by on-going cargo shipments transferred at Rankin Inlet or northern Keewatin airports. Despite the slightly higher per tonne-km rates charged on the services out of Winnipeg/Churchill than out of the East, the flying distances are so much shorter that the total costs of cargo shipments typically range from \$1,000 to \$2,000 per tonne from origin to destination. Costs from the East or West range between \$2,000 and \$3,000 per tonne if delivered directly and from \$3,000 to \$5,000 if redistributed from the initial point of deplane-ment.

For unit toll air cargo, the Central corridor offers a further advantage in that the railway line serving Churchill can reduce the effective flying distances from Winnipeg to the study area by approximately 600 n.m. for non-priority and perishable shipments. Such cargo can be shipped from Winnipeg to Churchill by road/rail and then north from Churchill by air, at lower overall cost than if shipped by air directly from Winnipeg. The rail/air system, however, is reported by shippers to have a high loss rate on perishables and small shipments and so such cargoes tend to bypass Churchill.

It appears that Winnipeg/Churchill suppliers could be competitive over a wider territory than is now served. Possibly they do not compete because the indirect costs associated with the available levels of service and reliability offset the distance advantage.

4.2.3 Factors Influencing Unit Toll Resupply

In an unregulated environment, a carrier serving a route must balance level of service against operating cost. On short routes the tendency is to operate smaller aircraft on higher frequencies, while on long routes the reverse is generally true. On most domestic routes in Southern Canada air cargo is not a major determinant of route structure since on such routes cargo operations are a by-product of surplus belly capacity

available on passenger aircraft. On most Northern routes however, passenger volumes are often inadequate by themselves to support effective passenger service and so on many routes combined passenger and cargo flights are provided using combie aircraft specially configured for this type of service.

There is, however, no uniformity in practice. For example Nordair, on their Montreal Frobisher Bay service, operate Boeing 737 combies and thereby provide a higher passenger level of service than if cargo and passenger services were provided separately. PWA, on the other hand, operate a lower frequency pure passenger service with a similar aircraft⁴ but with belly cargo capability only, between Winnipeg and Churchill. The termination of the PWA flight at Churchill has enabled Northwest Territorial to bypass Churchill with a twice weekly non-stop combie service between Winnipeg and Rankin Inlet. This development raises the question as to whether in future, Churchill will remain an important hub for unit toll passenger and cargo traffic or whether Rankin Inlet will supercede it. Some insights into this question can be obtained by examining aircraft operating costs.

Because of the limited scale of passenger operations and the large number of carriers operating in the corridor it is difficult to establish comparative passenger aircraft operating costs, particularly since the majority of the carriers have operations both in the North and the South and so a degree of cost sharing between routes in the two regions can be expected to exist. However, an approximation can be obtained by comparing the published tariffs for charter aircraft operating from Churchill. The comparative data based on 1982 information is shown in Exhibit 4.4. Discussions with the CTC indicated that on average unit toll tariffs for cargo are increasing at the rate of approximately 5 percent per

4. It is understood that the Boeing 737 aircraft generally in service is a quick change model which allows it to be quickly converted from a passenger to cargo or vice versa or to a combie configuration.

EXHIBIT 4.4

COMPARISON OF TARIFFS, CHARTER AIR SERVICES CHURCHILL TO RANKIN INLET TYPICAL AIRCRAFT

AIRCRAFT TYPE	NOMINAL LOAD		TARIFF (1982)*	
	(lbs)	(kg)	(¢/kg)	(¢/kg/km)**
McDonald Douglas DC-3	5,000	2,276	149	0.10
British Aerospace HS748	10,000	4,535	105	.072
McDonald Douglas DC-4	15,000	6,800	72	.048
Lockheed Electra 488	20,000	9,070	62	.042
Boeing 737-200C	30,000	13,600	59	.040
Lockheed Hercules L100-20	40,000	18,145	63	.043
Lockheed Hercules L100-30	50,000	22,648	43	.029

* 1985 tariffs are estimated to be about 16% higher than 1982 tariffs, on average

** Based on a 1,500 km (810 n.m) trip length

SOURCE: The Role of Churchill in the Transportation System for Northern Canada, CTC Report 1983/03E.

annum on a system-wide basis. All of the aircraft types, with the exception of the Hercules L-100 models⁵ are available in both cargo and passenger configurations. The figures shown apply to cargo operation only (they do not include allowances for cabin crew and passenger services) and so reflect the basic operating cost of each type of aircraft exclusive of passenger servicing costs.

The data demonstrate the relative cost advantage inherent in operating larger, more productive aircraft. The practical effect of this can be demonstrated by the recent developments in the Winnipeg/Rankin corridor. Prior to January 1981 the unit toll services in the corridor consisted of a connecting service: a Boeing 737 turbojet service between Winnipeg and Churchill connecting with a Calm Air turboprop HS 748 service between Churchill and Rankin Inlet. In 1981, NWT commenced a non-stop service between Winnipeg and Rankin Inlet using Lockheed Electra (L188) turboprop combies. The unit toll tariffs from Winnipeg to Rankin Inlet are:

	Cargo Rates \$/kg (1982)*	Passenger Fares \$ one way (1985)
PWA (Winnipeg-Churchill)	84	242
Calm Air (Churchill Rankin)	79	199
Combined	163	441
NWT (Winnipeg-Rankin)	118	430

* 1985 unit toll tariffs would be approximately 15 percent higher on average. The NWT unit toll tariff Winnipeg/Rankin Inlet in 1985 was 150¢/kg.

The policy of NWT appears to be to compete on the basis of level of service for passengers and on the basis of price for cargo. The wide differential in cargo rates is due to the improved productivity of the

5. It is understood that these models no longer operate regularly in the corridor.

Electra over the HS 748. The service provides competition for the road/rail/air cargo unit toll service combination through Churchill but volumes remain small. The combined tariff for the latter service, the major one, is volume dependent and the differential compared to the direct air service can be as low as 20¢/kg for small shipments (possibly higher for perishables, particularly if losses in transit are taken into account) increasing to approximately 25¢/kg for larger volume shipments.

For the Central and Eastern Arctic (excluding PWA flights from Winnipeg to Churchill) average unit toll revenues were \$2.23 per passenger kilometer⁶ and \$1.09 per cargo kilometer, a ratio of 2.13. Extrapolating the 1982 PWA cargo rate Churchill/Winnipeg to reflect the longer distance between Rankin and Winnipeg results in a tariff of 123¢/kg vs. 118¢/kg charged by NWT for that year. This suggests that the NWT air cargo rates are probably near break even and that both rates reflect heavy rail competition. On this route, the revenue per passenger kg was \$4.77 compared with \$1.50 per cargo kg, a ratio of 3.1. This ratio partly reflects lower cargo rates made possible by the Hudson Bay Railway and partly a heavier cross-subsidization of cargo traffic by passenger traffic.

Based on typical aircraft operating costs, and assuming acceptable load factors, NWT could probably reduce their unit passenger tariffs Winnipeg/Rankin from \$430 to approximately \$355 using their present equipment. This would make it very difficult for the Calm Air/PWA service to compete for Winnipeg/Rankin Inlet traffic unless PWA were prepared to absorb some of the loss of revenue or Calm Air could justify the acquisition of more productive aircraft.⁷

6. Assumes 90 kg per passenger.

7. Assuming adequate load factors, a carrier operating a B737 quick change combie aircraft could theoretically offer fares 10 to 15 percent below those possible with a Lockheed L188.

The conclusion therefore is that the aircraft already in service in the corridor can economically provide a non-stop service to Rankin Inlet thereby possibly limiting the growth of connecting passenger traffic through Churchill. Unit toll cargo rates on direct flights from Winnipeg already appear minimal so that additional diversion of traffic from Churchill to direct flights should not increase significantly above present levels.

If NWT does not acquire unit toll passenger and cargo rights at Churchill (or if the PWA service is not extended beyond Churchill), a system would evolve whereby Churchill would be the connecting hub for northbound traffic on PWA flights and Rankin Inlet the connecting hub for NWT passengers. The question therefore which is addressed below is whether Keewatin passengers to secondary points would in future choose Churchill over Rankin Inlet as their point of connection.

4.3 THE OPPORTUNITY FOR A WINNIPEG NORTH AIR SERVICE

There are two principal opportunities to route more traffic along an axis through Winnipeg and Churchill. The first option is to attempt to attract both passengers and cargo on to a route via Winnipeg. The second option is to concentrate on attracting more cargo only. From the point of view of Manitoba, it would be beneficial to route more traffic through either Winnipeg or Churchill. However, this study is specifically concerned with resupply through Churchill. To achieve the objective of greater traffic through Manitoba and to direct at least some of the generated benefits to Churchill, the most advantageous air route would be Winnipeg-Churchill-Rankin Inlet-Hall Beach-Nanisivik-Resolute. This passes along the central axis of the area naturally tributary to Winnipeg-Churchill and connects the principal existing traffic hubs in the corridor.

This section discusses:

- o the possibility of attracting passengers and cargo;

- o the option of concentrating on a cargo route;
- o the role of Churchill in such a route.

4.3.1 The Passenger and Cargo Option

The number of annual passengers for a Class 1 or 2 service on a Winnipeg North route is estimated in Exhibit 4.5 as 15,500 originating or terminating in the Arctic. This is based on the analysis of Exhibit 2.13 which indicate that a Class 1 or 2 service attracts about 40 percent of the passengers at a community served by a Class 1 or 2 carrier and about 15 percent of the passengers at a community linked by a small carrier to a Class 1 or 2 hub. However, given the existing service and linkage to Montreal and Southern Ontario, it would not be expected that such a volume could be attracted initially. Rather it should be considered to be a longer term target.

The next major traffic centre in the corridor north of Rankin Inlet is Hall Beach with its linked communities of Igloolik and Pelly Bay. It is an important station on the DEW line and is directly served by a Nordair Boeing 737 once weekly flight from Montreal.

To attract passengers from Hall Beach (the first hub with no existing direct linkage to Churchill or Winnipeg), it would be desirable for the fare to Winnipeg (1,293 n.m) to be lower than the existing fare of \$509 to Montreal. Hence the aircraft used should be able to offer a fare of less than \$0.40 per n.m for the distance involved.

Typical unit toll passenger tariffs on routes in the area are:

EXHIBIT 4.5

ESTIMATED PASSENGERS FOR A WINNIPEG NORTH AIR SERVICE

	POPULATION		UNIT ROLL PASSENGERS		Present Level 1 from Hub Community	Estimated Level 1 with Wpg Service	Estimated Level 1 from Hinterland	Total Level 1	% to Winnipeg Service	Total for Winnipeg Service
	Hub Community	Hinterland	Community	Hinterland						
Arctic Communities In Study Area										
Rankin Inlet	1,239	3,423	5,576	12,997	1,510	2,500	1,900	4,400	100%	4,400
Hall Beach	399	3,020	5,500	11,733	1,690	2,500	1,800	4,300	70%	3,000
Nanisivik & A/B	718	1,440	3,080	6,723	3,610	4,000	1,000	5,000	40%	2,000
Resolute	142	0	11,600	0	8,740	9,000	0	9,000	30%	2,700
TOTAL	2,498	7,883	25,756	31,453	15,550	18,000	4,700	22,700		12,100
Arctic Communities Outside the Study Area										
Cambridge Bay					3,160				20%	600
Frobisher					18,800				15%	2,800
TOTAL					21,960					3,400
Arctic Total Churchill					10,450	12,500				15,500
TOTAL										12,500
										28,000

<u>Aircraft Type</u>	<u>Route</u>	<u>Distance</u> (n.m)	<u>Air Fare</u>	
			\$	cents/n.m
B737*	Winnipeg/Churchill	605	199	33
B737 Combie	Hall Beach/Montreal	1,293	509	33
	Hall Beach/Frobisher	429	229	58
L188 Combie	Yellowknife/Frobisher	1,285	744	58
	Yellowknife/Rankin	645	408	63
	Rankin Inlet/Winnipeg	850	430	51
HS 748 Combie	Churchill/ Coral Harbour	445	364	82

* All passenger configuration.

This suggests use of a B737 combie, given the high cargo volumes on the route, if the service is to be price competitive with service to Montreal. A direct service by HS 748 from Rankin Inlet to Hall Beach would result in an improved level of service over the existing situation but would not generate substantial amounts of new traffic because the rates which could be offered would not be sufficiently attractive.

A Boeing 737-200C aircraft operating from Churchill to Hall Beach could carry a payload of approximately 16,000 kg and, operating from the shorter 1,500 m runway⁸ at Rankin Inlet, approximately 14,000 kg. Assuming a combie configuration of 60 seats, and a once weekly service (passenger load factors of 50 percent and cargo load factors of 85 percent) a B737 could annually deliver 3,100 enplaning and deplaning passengers (i.e., 6,200 two-way passengers) and 440 tonnes of guaranteed cargo from Churchill (only 350 tonnes of guaranteed cargo from Rankin Inlet).

The Lockheed L188 has a seating capacity of 98 plus 1,800 kg of cargo. Assuming a 45 seat combie configuration, and the same load factors

8. A 1,500 m runway is considered marginal for economic B737 operation and maximum length of 1,650 m should be provided for passenger operations.

as for the B737-200C, the aircraft could deliver 2,300 enplaning and deplaning passengers and 165 tonnes of cargo annually from either Churchill or Rankin Inlet.

Given the estimated potential of 15,500 passengers in the corridor and the possibility of attracting a proportion of the over 10,000 tonnes of cargo presently routed from the East and West, the target of once a week Boeing 737 service as far as Hall Beach appears feasible. However, a market survey of existing users of the services of Class 2 carriers would be desirable to determine, for example, how much travel is to visit government or Ontario/Quebec head offices and how much is optional to visit any major Southern centre.

Beyond Hall Beach to the north, the three corridors (Winnipeg, Montreal and Edmonton) converge to the point where the geographic advantage enjoyed by Winnipeg is no longer a major consideration. Two of the communities in the zone, Arctic Bay and Nanisivik are closely linked with Frobisher Bay and Montreal, and the third, Resolute, already has direct air links with both Edmonton and Montreal. Implementation of a direct service between Hall Beach and Winnipeg would improve local connections to Arctic Bay and Nanisivik and to a lesser extent to Resolute. In the short term, this is possibly the best that can practically be achieved.

Exhibit 4.5 provides an estimate of the additional traffic that might be attracted to a Class 1 service operating between Winnipeg, Rankin Inlet, Hall Beach, Nanisivik and Resolute. Based on these estimates approximately 7,300 passengers would be attracted from Rankin Inlet/Hall Beach and 4,700 from Nanisivik/Resolute.

4.3.2 The Air Cargo Option

As has been noted above, there are over 10,000 tonnes of cargo and mail delivered in and adjacent to the study area from the East and West, while there are also significant volumes (about 10,000 tonnes) into

Keewatin from Winnipeg and Churchill. In addition there is a Winnipeg/Hall Beach weekly cargo charter.

A logical expansion to existing services would be to extend north from Churchill with a unit toll (cargo only) or regular charter to at least Hall Beach and perhaps further. The unit toll rate for the 1,575 km from Winnipeg to Rankin Inlet amounts to .075¢/kg/km. Exhibit 4.4 shows charter rates (1982) for various types of aircraft over a 1,500 km trip length. Applying the costs (in ¢/kg/km) to the Lockheed Electra, Boeing 737 or the Lockheed Hercules L100-30, as examples, the cost of delivering full loads from Winnipeg or Churchill to Hall Beach would be:

	Distance		Unit Toll Electra (\$/tonne)	Charter (\$/tonne)		
	n.m	km		Electra	737	L100-30
Winnipeg/ Hall Beach	1,293	2,395	1,796	1,006	958	695
Churchill/ Hall Beach	726	1,345	1,009	565	538	390

The charter values are clearly low estimates, representing the rates achievable by employing full aircraft loads. However the rates are comparable with the \$1,000 per tonne revenues for present Keewatin service by unit toll and significantly below the \$2,000+ values for services by unit toll from the East.

It is also noteworthy that there is a significant cost saving to a shipper by using rail service to Churchill and then transferring to air shipment north from there. At high volumes, using full trailer loads and full chartered large aircraft, a lowest cost rate from Winnipeg to Hall Beach is:

	<u>\$/tonne</u>
Winnipeg-Churchill by Rail	123
Forwarding	80
Hercules L100-30 to Hall Beach	<u>300</u>
	503

While some air freight service requires immediate delivery by the next available flight, the prime choice in the Arctic communities is between once-a-year marine service or the alternative air service. In such a choice, the option of overland from Winnipeg to Churchill followed by air service may well provide a fully adequate level of service while being significantly less expensive than supply by air all the way, provided that the surface system can provide an appropriate level of service at a reasonable cost. Because of limited competition in the market, modest savings in shipping costs are of less importance to the shippers than are service reliability and minimal damage and losses to cargo.

Unit toll cargoes on a unit weight basis do not generate the same level of revenues as do passengers but related incremental operating costs are lower. On routes with low traffic demand, cargo shipments can be the determining factor in service viability. In this regard Churchill has an advantage in that the CN rail line provides an opportunity to increase air freight revenues to Northern points by allowing aircraft to top up with rail delivered cargo at Churchill. However, the differential rate advantage favoring the road/air system over the all air mode is not overwhelming and therefore surface transportation costs must be controlled, and even reduced. This includes the direct and indirect costs associated with forwarding the cargo from rail to air at Churchill. Furthermore, the reliability of the system must be improved and wastage of perishables and damage to shipments must be reduced to near the level obtaining on direct air shipments.

Hence, establishment of such a routing requires facilities at Churchill which minimize spoilage and damage of cargo during transfer and

during storage waiting for favourable weather conditions or for the next aircraft flight.

The annual volumes able to be delivered by a once-weekly aircraft carrying the nominal loads of Exhibit 4.4 (about 85 percent of capacity) are as follows (in tonnes):

Electra	470
737-200C	710
Hercules L100-30	1,180

Given the total demand of over 10,000 tonnes a year in an area which could be serviced by redistribution from Hall Beach, there is an opportunity to target 25 percent or 2,500 tonnes a year. This would justify a several times a week service committed to cargo. This option will be very attractive if an upgraded road/rail link to Churchill becomes a reality. It will increase total cargo from the South from 9,500 tonnes to 12,000 tonnes (or 11,000 tonnes if air traffic is diverted to NTCL Marine through a rate change).

4.3.3 The Role of Churchill

The existing air linkages in the Churchill area are:

PWA	Winnipeg to Churchill - then no further
Calm Air	Churchill to Rankin Inlet ⁹
NWT	Winnipeg to Rankin Inlet

NWT tariffs are such that it is less expensive to travel or ship goods by NWT from Winnipeg to Rankin Inlet than by the PWA-Calm Air connection. This is possible because of the higher productivity of NWT's Electra in comparison with an HS 748-B737 combination. Hence some Winnipeg to Rankin Inlet traffic by-passes Churchill.

9. Calm Air have recently had Winnipeg added to their licence.

For passengers to Keewatin points, the comparison is between an HS 748-Electra combination or an HS 748-B737 combination. The fare comparisons are (in \$):

<u>Winnipeg to</u>	<u>Via Churchill</u>	<u>Via Rankin Inlet</u>
Eskimo Point	364	575
Baker Lake	492	502
Chesterfield Inlet	536	525
Coral Harbour	563	664
Repulse Bay	612	672

Other than for Chesterfield Inlet, the fares favour routing via Churchill. Inasmuch as Churchill had 3,900 connecting passengers in 1984 compared with Rankin Inlet's 200, it appears that costs and the level of service of the B737 connection to Winnipeg still attracts more connecting passengers to Churchill than does the NWT service to Rankin Inlet. However, Churchill is clearly vulnerable to more traffic losses, if other direct flights such as Winnipeg-Baker Lake were to be introduced.

The increased role of Churchill as a hub for unit toll passenger traffic in an extended corridor is problematic. While it is the largest community in the area, its population as a proportion of the total corridor population is small, in the range of 20 to 25 percent. Unlike Rankin Inlet, which is smaller, it has no major local government institutions (apart from the hospital) which are high generators of trips into the Keewatin. Furthermore, living costs approach those found in the Arctic and therefore, while there may be a greater variety of goods and services available in Churchill, they are not overwhelmingly cheaper than those available in the larger Arctic communities further north. The number of flights that an operator would be prepared to transit through Churchill is a function of the volume of locally generated traffic. If Churchill is to ensure its development as a resupply centre for the Arctic, positive steps must be taken to ensure that the goods and services required by inhabitants of more northerly communities can be obtained there at prices competitive with those obtaining further to the south, allowing for the extra transportation costs.

If a pattern of overflying Churchill becomes established, changes will be difficult to achieve and therefore improvements at Churchill will have to be made soon if they are to be fully effective.

If Churchill is to maintain and expand a function of resupplying communities north of it, it should be on the route of an airline serving most or all of the Central corridor. As long as this is only Calm Air, Churchill remains vulnerable to overflying by NWT or PWA. Churchill's objective should be to be located on the route of a carrier serving Winnipeg-Churchill-Rankin Inlet-Hall Beach and ultimately beyond to Nanisivik and Resolute.

If the lower cost/higher level of service road/rail link between Winnipeg and Churchill as suggested in this study is implemented, then Churchill should be able to provide economic rail/air links, with high service levels, thereby reducing the risk of losing traffic to non-stop services from Winnipeg to more northerly destination points. If the road/rail link were to handle substantially all of the existing cargo which is dispatched from Winnipeg, Thompson or Churchill (as it currently does) plus all of the target diversion from Eastern and Western origins, about 10,000 to 11,000 tonnes of air traffic would be shipped over the rail line. In addition, Churchill airport would continue to handle connecting cargoes between air carriers where mutually beneficial, e.g., PWA to Calm Air.

4.4 SUMMARY OF AIR RESUPPLY CONCLUSIONS

The present situation in which Churchill is supplied with a Class 1 PWA Boeing 737 service from the South and a Class 3 carrier (Calm Air) to the North severely limits its options and leaves it vulnerable to diminishing service in future.

The relatively higher unit costs associated with small aircraft limit the market potential of Churchill to the Southern communities of the Arctic. Also, each new overflight from Winnipeg to a Keewatin community

(such as Rankin Inlet and perhaps others in future) threatens to reduce Churchill's resupply role. It is recommended therefore that consideration be given either to granting of pick up rights to NWT at Churchill for their Winnipeg/Rankin Inlet service or the extension of a B737 combie service by PWA to Rankin Inlet.

To retain and expand its air resupply role, Churchill needs to be on a route including Winnipeg-Churchill-Rankin Inlet-Hall Beach and points further north. This will require a restructuring of the air services currently available in the corridor. This could seriously affect the profitability and the continuing viability of some of the existing services in the corridor. The Government of the Northwest Territories and the Government of Manitoba, should initiate a review of air services in the corridor with a view to restructuring the current system to allow greater competition and the extension of Manitoba originating air services northward.

An at least once-a-week cargo service from Churchill, using a B737 or L188 combie, would supply cargo into Hall Beach at prices well below those from Montreal. A target of 2,500 tonnes of cargo a year appears possible. If the level of service of the Winnipeg/Churchill road/rail link and of transfer and storage (if necessary) at Churchill can be improved, as recommended elsewhere in this report, this air link to Rankin Inlet and Hall Beach, with subsequent transshipment to other Baffin communities, appears very promising.

5. OPERATIONS AND INFRASTRUCTURE

This Chapter briefly describes the salient features of the physical plant and infrastructure associated with both the marine and air resupply services at Churchill. A detailed physical description of the marine resupply system is contained in Appendix A (facilities at Churchill) and Appendix B (facilities at the six Keewatin ports). Appendix D provides inventory information on the air resupply system at all relevant locations.

5.1 MARINE FLOATING PLANT

The NTCL Marine resupply operations from Churchill are provided by a single tug and four barges. All four barges have the capability to transport petroleum products and dry cargoes simultaneously. Two of the barges have open dry cargo decks and two have covered decks.

The barges are used in pairs, one covered and the other open. During a typical cycle, one pair is being loaded at Churchill while the second is on delivery service. Typically, 3000 tonne bulk fuel and dry cargoes combined are handled on a single voyage. The floating plant is wintered in dry dock at Churchill and consequently operates for less than three months in a typical season. Generally, the coastal shipping season opens as early as two weeks before the deep sea season and closes earlier by a similar amount.

The average sailing speeds in relatively open water range from 5-1/2 knots to 7-1/2 knots. Typical cycle times for the existing services are outlined in sub-section 2.6.1 and tonnages carried in sub-section 2.6.2.

5.2 PORT CHURCHILL OPERATIONS

A typical barge loading cycle at Churchill involves the following steps:

- o Two empty barges are docked along the east face of the wharf opposite the open wharf area leased by NTCL. These berths are shallow so that barges rest on the bottom under low tides which facilitates loading by limiting the vertical movement of the vessel. The loading is accomplished primarily by using wheeled equipment traveling on portable ramps linking the wharf and barge decks. Neither the wharf or the barges are equipped with fixed cranes or special container handling facilities. The loading and unloading system is primarily roll-on and roll-off involving a range of wheeled equipment.

At the completion of the loading cycle, the portable ramps and the equipment required to off-load at the outports are stowed on board.

Cargo is transferred either from the open wharf area or from the transit shed, part of which is leased by NTCL from Ports Canada. The shed can accommodate fully loaded boxcars. It is used by NTCL to consolidate, shrink wrap and protect outboard shipments.

The barges are then towed to a deeper berth at the north end of the Ports Canada wharf where bulk petroleum products are loaded from a fixed hydrant system located on the wharf. The system is connected by pipeline to the main fuel farm located immediately to the east of the grain elevator area. The fully loaded barges remain afloat before being towed.

The returning tug drops its barges and docks along the west face of wharf immediately to the north of the grain loading berths where it is serviced. The two loaded barges are harnessed, the tow cables connected and the barges are towed from the harbour. The smaller of the two Ports Canada harbour tugs positions the two empty barges along the wharf and the loading cycle is repeated.

5.3 OUTPORT OPERATIONS

There are no suitable fixed dock or cargo unloading facilities at any of the outports serviced by NTCL. The unloading procedure generally followed is to anchor offshore and to unload the petroleum products from

the first barge using floater hose. The unloaded barge is then beached at high tide at a specially prepared location on the fore shore, where it is unloaded using the portable ramps and mobile equipment (e.g., fork lifts, trailers, etc.) previously stowed on board at Churchill for this purpose. The unloading operation is assisted by supplementary stevedores flown in from the NTCL base at Churchill.

The second barge is unloaded following the same sequence as for the first. The two empty barges are then pulled off the beach by the tug and returned to Churchill.

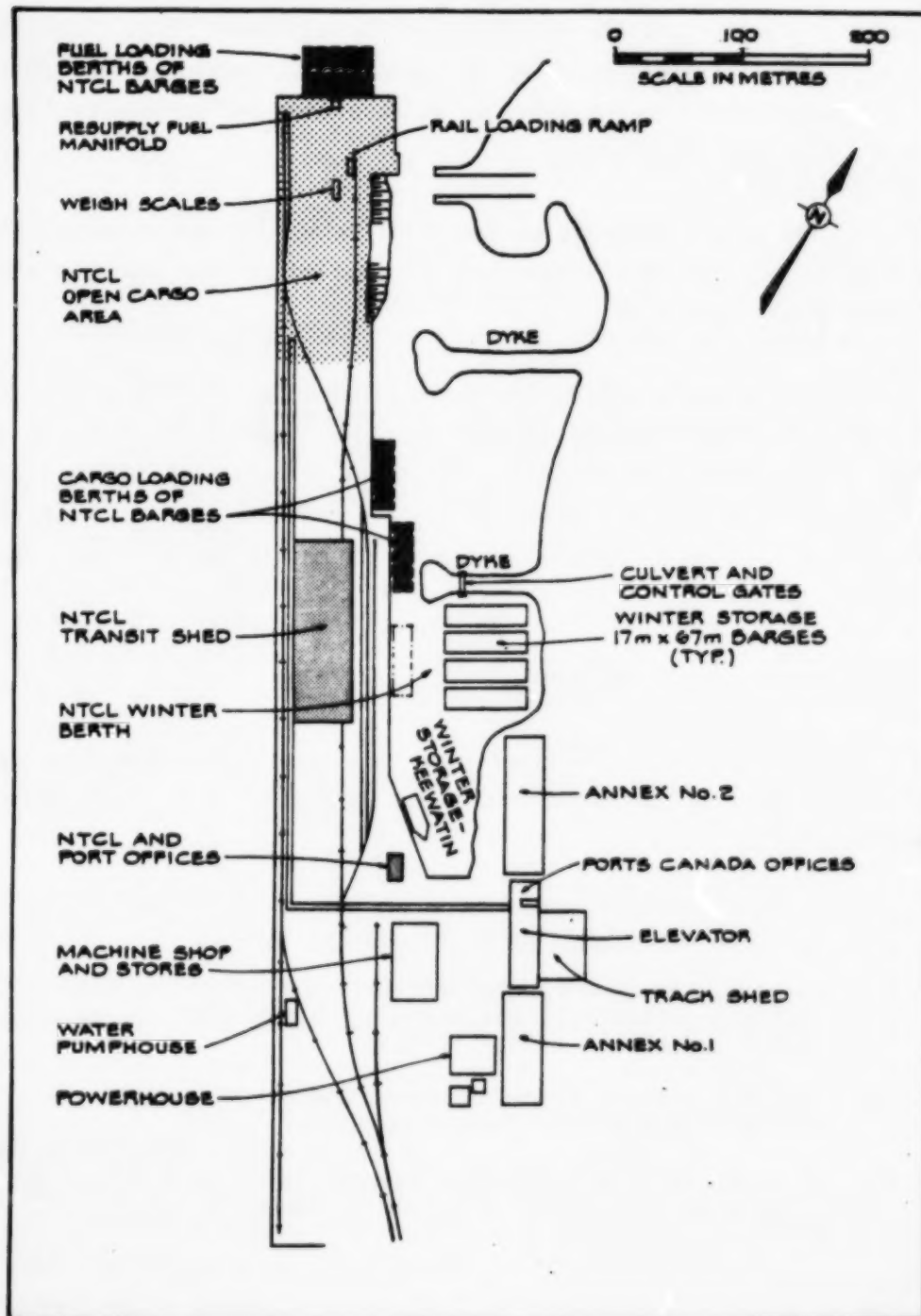
The complete cycle, Churchill-outport-Churchill generally takes 7.5 days, which considerably exceeds the time required to load the barge docked at Churchill. Consequently, it is the productivity of the floating system (e.g., the tug and barges en route and at the outport) rather than that of the Churchill loading system which mainly governs the resupply capability of the Port.

5.4 PORT FACILITIES AT CHURCHILL

The layout of the fixed port facilities associated with marine resupply at Port of Churchill are shown in Exhibit 5.1. The principal elements are:¹

1. A covered transit shed (8,000 sq. metres floor area) of which 75 percent is leased and used by NTCL.
 2. An open storage and cargo handling area comprising the northern portions of the wharf, including rail spurs, scales and railcar unloading dock.
 3. Marginal wharves on the two sides and at the north end of the open wharf area leased by NTCL.
 4. A fixed bulk fuel transfer system including a barge loading hydrant system linked to the main fuel storage farm.
-
1. It is understood that NTCL have recently completed construction of a staff house for their personnel. Up to the present, this service was provided by Ports Canada and charged for.

exhibit 5.1
PORT OF CHURCHILL
NTCL PORT FACILITIES



5. A winter berth capable of accommodating the NTCL tug and four barges.
6. NTCL office accommodation rented from Ports Canada.
7. Rail and road links.

Photographs of the NTCL floating plant and Port Churchill supply operating area are shown in Exhibits 5.2, 5.3 and 5.4.

5.5 POSSIBLE IMPROVEMENTS IN OPERATIONS OR INFRASTRUCTURE

Both the present and the previous NTCL contracts were fixed term. Short term contracts of this nature do not encourage fixed capital investment by the Contractor to improve labour productivity. As a consequence, substantially all the NTCL investment is in marine, mobile and portable plant. Nor does the agreement encourage training of labour at the outports to reduce barge to door delivery costs. Furthermore, the extent of the service area is sufficiently limited to permit easy delivery of available cargoes within the present season so that there are no major incentives to improve the productivity of the operation provided that revenue targets can be met.

It is suggested in Chapter 3 that the resupply throughputs could be increased at Churchill in two ways: firstly by allowing Sealift vessels to use the Port, and secondly, by increasing the territory served by NTCL.

The suggested methods of increasing NTCL shipments would be either to extend the season or to increase the fleet size to three barges on each journey. Extending the season would not significantly increase peak demands on facilities, but increasing from two barges to three barges per voyage would at a minimum increase the berthing space required by 50 percent. The actual barge loading time is considerably shorter than berth occupancy time, so that any conflicts which might occur due to lack of berths could be resolved by anchoring barges away from the dock or mooring two barges side by side at a single berth. If necessary, a moveable ramp installation could be provided at the north end of the wharf to permit loading of dry cargoes at all tidal stages.

exhibit 5.2
PORT OF CHURCHILL
NCTL MOBILE PLANT



tug

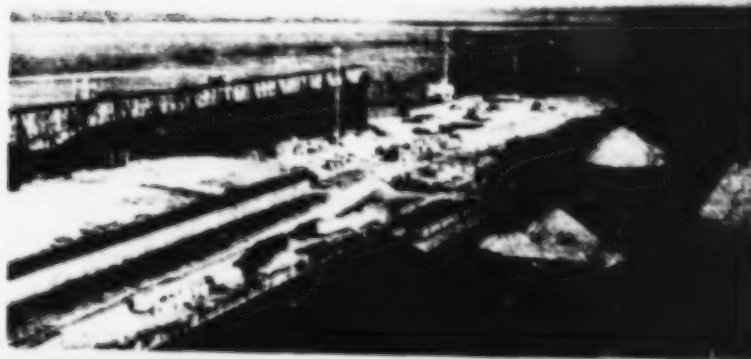


open barge



covered barge

exhibit 5.3
**PORT OF CHURCHILL
NTCL TRANSIT SHED**



transit shed
& barge

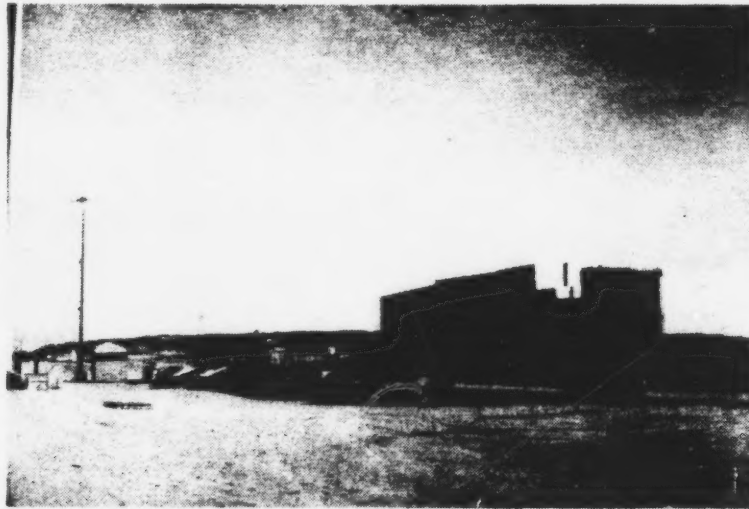


transit shed
interior

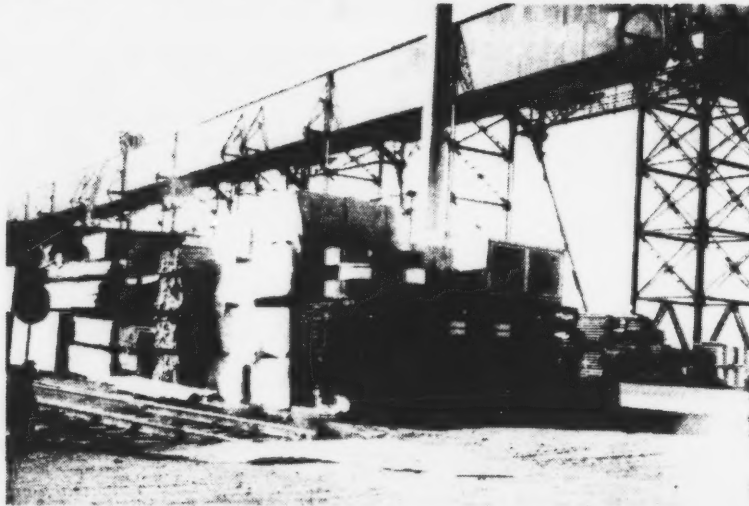


dry cargo
loading berth

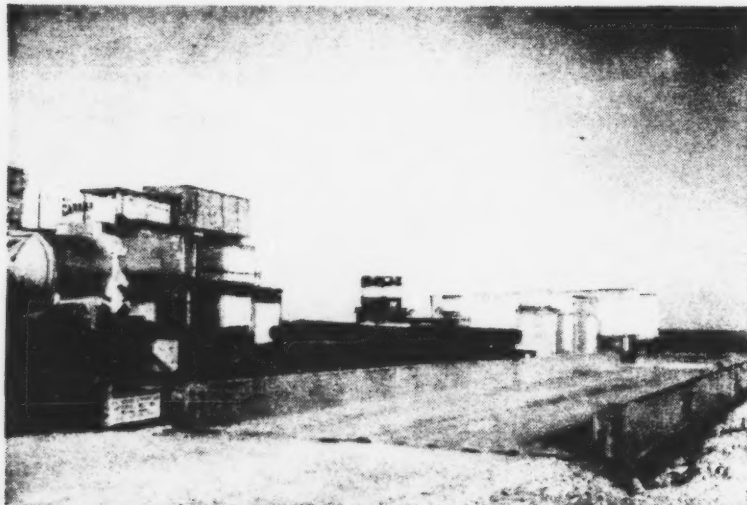
exhibit 5.4
**PORT OF CHURCHILL
NTCL GENERAL STORAGE**



rail dock



general storage



scales

The handling of Sealift vessels could pose a problem, in that most of the space on the open wharf north of the transit shed is utilized by NTCL for cargo storage at peak times. Since there are no alternative uses for this space at present, storage is less effectively organized than it otherwise might be. Under-utilized open wharf space is also available to the south of the transit shed. Longer term open storage could readily be provided adjacent the railway corridor within the town area. Therefore, providing additional open storage is more a problem of organizing the existing space than of developing new areas.

Covered storage would be a problem since NTCL currently utilize all the space available to them in the Ports Canada transit shed. The efficiency of its utilization could most likely be improved to handle increased NTCL shipments, but accommodating other operators would be difficult and probably impractical. The Sealift vessel operators would therefore have to make arrangements for the use of storage facilities which exist outside the Port area.

There are potential conflicts in the use of berth facilities. Two berths at a minimum are required for grain loading and the third is desirable for vessel inspection. On average, the NTCL tug Keewatin is in Port one day in a 9-day cycle. The estimated six to ten trips by Sealift vessels annually would result in an additional berth occupancy demand of between 12 and 20 days. The total occupancy requirement of all resupply operations would be 20 to 30 days for a short berth. This demand can probably be accommodated within the surplus capability of the existing system, but may necessitate the occasional anchoring of idle vessels off berth for short periods.

5.5.1 Outport Fixed Facilities

The harbour conditions at the Keewatin resupply ports are shown in Appendix B. Apart from fixed fuel storage facilities (listed in Exhibit 5.5) no resupply related permanent harbour facilities exist at any of the existing or proposed resupply communities.

EXHIBIT 5.5

PETROLEUM RESUPPLY SYSTEM SELECTED ARCTIC COMMUNITIES

COMMUNITY	GASOLINE CAPACITY	(¢/LITRE)	OIL (P-150) CAPACITY	(¢/LITRE)	RESUPPLY	MAJOR COMPANY
Arctic Bay	184,000	.64	948,000	.54	Non-annual	Panarctic Oils
Baker Lake	644,000	.62	3,685,000	.55	Annual-barg	
Cape Dorset	983,000	.63	4,108,000	.53	Annual-tanker	
Chesterfield Inlet	368,000	.63	1,750,000	.54	Annual-barg	
Coral Harbour	481,000	.65	2,252,000	.55	Annual-barg	
Eskimo Point	735,000	.63	3,342,000	.54	Annual-barg	Shell
Frobisher Bay	N/A	.65	50,000,000			
Gjoa Haven	551,000	.70	2,440,000	.65	Annual-barg	
Grise Fiord	92,000	.61	359,000	.55	Annual-tanker	
Hall Beach	414,000	.61	1,840,000	.54	Annual-tanker	
Igloodik	643,000	.61	2,770,000	.51	Annual-tanker	Panarctic
Lake Harbour	425,000	.63	1,391,000	.51	Annual-tanker	
Nanisivik	11,000,000					
Pangnirtung	957,000	.61	3,283,000	.52	Annual-tanker	
Pelly Bay	451,000	.83	1,360,000	.76	Annual-aircraft	
Pond Inlet	572,000	.64	1,992,000	.53	Annual-tanker	Imperial Oil Dome Canmar
Rankin Inlet	989,000	.63	4,053,000	.54	Annual-barg	
Repulse Bay	367,000	.60	1,198,000	.53	Annual-tanker	
Resolute	N/A				Non-supply	
Sachs Harbour	276,000	.61	1,000,000	.57	Annual-barg	
Spence Bay	459,000	.70	2,020,000	.65	Annual-barg	
Whale Cove	851,000	.63	1,327,000	.53	Annual-barg	

Source: NWT Data Book 1984-85

The unloading operations at Rankin Inlet, the busiest outpost in the NTCL system, occur on three occasions annually and last a total of approximately eight days. At each of Eskimo Point and Baker Lake, the next two busiest ports, two trips are made annually involving five days of port time at each site. The other ports are generally served once or occasionally twice annually.

At Rankin Inlet, fixed facilities could reduce the time spent in port by NTCL by about three days in total, each year. Also, local employees, if trained, could better handle cargo off-loaded from barges to a fixed wharf than directly from beached or floating barges onto the beach. Assuming alternative uses for the NTCL barges and tug, a three day time saving could result in a direct annual benefit to NTCL of \$48,000 and a four day saving would be worth \$64,000. (There could also be a benefit to the local economy from the use of local labour for delivery.) There would also be some saving in maintenance since the beach landing area has to be rebuilt each year. The direct benefit to NTCL could justify a capital expenditure in the order of \$320,000 to \$400,000 (Capital Recovery Factor = 0.15).

Available engineering information at the site is inadequate to make a firm construction cost estimate, but the order of magnitude cost for a facility capable of being used on all tides would \$1,000,000. A lesser facility, which would require that the barges rest on the bottom during low tides, might be built for about \$400,000. Capital expenditure of this order could not be justified unless required to permit NTCL to service a much greater area than at present.²

Fixed harbour facilities at Eskimo Point would cost approximately the same as at Rankin Inlet, but would produce much lower benefits and hence are not likely to be justifiable on the basis of the current cargo forecasts.

2. The estimates of potential increased traffic for NTCL are based on the incremental cost of NTCL operations and do not allow for recovery of capital cost of any fixed facilities required to increase the availability of their fleet.

The situation at Baker Lake is similar to that at Eskimo Point, insofar as potential benefits are concerned, but the capital costs involved for a dock would be much less than at either Rankin Inlet or at Eskimo Point because of the negligible tidal range that would have to be accommodated. The annual benefit to NTCL would be of the order of \$32,000 and this would justify a capital investment in fixed facilities of approximately \$200,000. Given the present under-utilization of the NTCL fleet, improvement of neither Baker Inlet or Baker Lake harbours is justified. However, it is suggested that a harbour plan be developed for both locations to ensure that any fixed harbour related facilities that might otherwise be implemented on an ad hoc basis would form part of a future cost effective harbour complex.

The plans should take into account that both areas are centers of on-going mineral exploration which could lead to the development of a producing mine thereby substantially increasing cargo shipments in and out of either area.

The unloading area at Coral Harbour is exposed to southerly winds and these have historically caused significant delays to NTCL operations. The unloading area is being relocated to a more sheltered location and this is expected to result in more acceptable operations.

Whale Cove and Chesterfield Inlet receive small cargoes and for the time being are not candidates for harbour improvements.

5.6 AIRPORT FACILITIES

An inventory of airport facilities in the existing and possible expanded resupply area is given in Exhibit 5.6. A more detailed description of the airport at Churchill and its site is shown in Exhibit 5.7. Appendix D provides more air system inventory information.

From the point of view of airside facilities, including landing aids and en route and navigation aids, Churchill airport fully meets the

EXHIBIT 5.6
AIRPORT INVENTORY
SELECTED NORTHERN COMMUNITIES

Location	Community Population (1981)	Operator	Runway Data				Principal Electronic Aid***	Comments
			No.	Length/Width (ft.)	Surface*	Pavement Load Rating		
Baker Lake	954	TC**	1	4200/150	Gravel	9.0	VOR/DME	
Cape Dorset	888	NMT Gov.	1	4000/100	Gravel	N/A	NDB	
Chesterfield Inlet	249	NMT Gov.	1	3000/100	Gravel	8.0	NDB	
Churchill		TC	2	9200/160	Asphalt	-	VOR/DME	PLR Available
Clyde River	443	NMT Gov.	1	3500/100	Gravel	N/A	NDB	Possible Soft Spots
Coral Harbour	429	TC	1	6000/200	Gravel	9.0	ILS/VOR/DME	
Eskimo Point	1022	NMT Gov.	1	4000/100	Gravel	9.0	NDB	
Frobisher Bay	2333	TC	1	9000/200	Asphalt	-	ILS/VOR/DME	PLR Available
Gjoa Haven	523	NMT Gov.	1	4400/100	Gravel	8.0	NDB	
Grise Fiord	106	NMT Gov.		2000/75	Gravel	8.0	NDB	Limited Winter Maintenance
Hall Beach	349	TC	1	5400/100	Gravel	9.0	VOR/DME	
Igloolik	746	NMT Gov.	1	3800/100	Gravel	8.0	NDB	Limited Winter Maintenance
Lake Harbour	252	NMT Gov.	1	1700/50	Gravel	N/A	NDB	Unlicensed
Nanisivik	261	TC	1	6400/150	Gravel	-	NDB	PLR Available
Pelly Bay	257	NMT Gov.	1	4590/100	Gravel/Clay	8.0	NDB	Unlicensed
Pond Inlet	705	NMT Gov.	1	4000/100	Gravel	7.0	NDB	
Rankin Inlet	1109	NMT Gov.	1	5000/150	Gravel	9.0	VOR/DME	
Repulse Bay	352	NMT Gov.	1	3400/100	Gravel	8.0	NDB	Unlicensed
Resolute	168	TC	2	6500/200	Gravel	9.0	ILS/VOR/DME	
Spence Bay	431	NMT Gov.	1	3610/100	Gravel	8.0	NDB	
Tuktayaktuk	772	TC	1	5000/150	Gravel	-	VOR/DME	
Whale Cove	188	NMT Gov.	1	4000/100	Gravel	8.0	NDB	Limited Winter Maintenance
Yellowknife	9438	TC	2	7500/150	Asphalt		ILS/VOR/DME	PLR Available

* Data refers to longest runway where more than one (winter runway can be longer).

** Transport Canada

*** Legend: NDB = Non-Directional Beacon
VOR = VHF Omnidirectional Radio Range
DME = Distance Measuring Equipment
ILS = Instrument Landing System
PLR = Pavement Load Rating

CHURCHILL AIRPORT VICINITY



requirements of resupply activities. In fact, in the context of likely demand it can be considered to have unlimited potential.

Passenger terminal facilities are inadequate, both in terms of capacity and environmental quality. However, it is understood that a new facility is planned and may be built under the Canada-Manitoba Subsidiary Agreement on Churchill.

The airport is a former defence base and some of the buildings constructed by the military are currently used by the civilian air carriers. Specifically, a large hangar, of which the passenger terminal is a part, is used by Calm Air for maintaining aircraft. Three small metal clad storage buildings are used by Calm Air, PWA and Costa Cartage as air cargo terminals. The cargo terminals and apron are shown in Exhibit 5.8.

A former U.S. military hangar complex, in good condition, exists near the intersection of the two runways, but is not connected to the existing road system. This facility could accommodate major expansion by an air carrier. Road facilities could be built when required at a cost in the order of \$200,000.

While individual aircraft are assigned to Churchill, for practical purposes no significant carrier is based there; Calm Air carry out some maintenance locally and Nunasi Central Airways and others have apparently expressed interest at one time or another in doing so. A main deterrent to basing operations at Churchill is the high cost of living. The present situation does not provide the benefits to Churchill that would result from operations based in Churchill. The high cost of living at Northern communities is a limiting factor in decentralizing of aviation facilities. As a consequence high speed, high performance aircraft, which can serve the region from Southern Canada, often have an advantage over slower, short range aircraft which must be based further north. Some indication of the relative cost of living in the study area is shown in Exhibit 5.9.

The cargo handling facilities at Churchill, as at other Canadian airports, are operated by the air carriers, since it is not the policy of

CHURCHILL AIRPORT CARGO



cargo ramp



cargo shed

EXHIBIT 5.9

CONSUMER PRICES AND PER CAPITA INCOME SELECTED ARCTIC COMMUNITIES

COMMUNITY	REGION	CONSUMER PRICE INDEX*	PER CAPITA INCOME (1981) (\$)
Arctic Bay	Baffin	1982 - 60-69% higher than Edmonton	-
Baker Lake	Keewatin	1982 - 60-69% higher than Edmonton	4,049.
Cape Dorset	Baffin	1982 - 60-69% higher than Montreal	3,267.
Chesterfield Inlet	Keewatin	1982 - 60-69% higher than Winnipeg	-
Coral Harbour	Keewatin	1982 - 60-69% higher than Winnipeg	-
Eskimo Point	Keewatin	1982 - 40-49% higher than Winnipeg	3,227.
Frobisher Bay	Baffin	1982 - 50-59% higher than Montreal	10,026.
Gjoa Haven	Kitimeot	1983 - 110-119% higher than Edmonton	3,038.
Grise Fiord	Baffin	1982 - 90-99% higher than Montreal	-
Hall Beach	Baffin	1982 - 60-69% higher than Montreal	6,865.
Igloodik	Baffin	1982 - 70-79% higher than Montreal	3,350.
Lake Harbour	Baffin	1982 - 50-59% higher than Montreal	3,127.
Nanisivik	Baffin	1982 - 60-69% higher than Edmonton	-
Pangnirtung	Baffin	1982 - 50-59% higher than Edmonton	3,413.
Pelly Bay	Kitikmeot	1983 - 130-139% higher than Edmonton	3,362.
Pond Inlet	Baffin	1983 - 70-79% higher than Montreal	3,888.
Rankin Inlet	Keewatin	1982 - 50-59% higher than Winnipeg	6,293.
Resolute Bay	Baffin	1982 - 60-69% higher than Montreal	-
Sachs Harbour	Inuvik	1983 - 90-99% higher than Edmonton	-
Spence Bay	Kitikmeot	1983 - 120-129% higher than Edmonton	4,153.
Whale Cove	Keewatin	1982 - 70-79% higher than Winnipeg	-

Source: NWT Data Book 1984-85

* Price differentials for various supplies at Winnipeg, Montreal and Edmonton are shown in Section 3.1.3. Appendix B of Study A contains living cost differential data for Churchill and other northern communities.

Transport Canada to invest in dedicated airline ground facilities. As a consequence, in Canada the airlines make the investment decision regarding new special purpose facilities. It is unlikely that any carrier would risk a major capital investment at Churchill without long term route guarantees.

The second major airport in the study area is at Rankin Inlet. It has a runway length of 5,000 ft., a new passenger terminal and a hangar capable of accommodating small aircraft. The runway currently accommodates L188 aircraft operating on moderate stage lengths. A factor favouring a short runway at this location is that outbound cargo loadings are low. Furthermore, use can be made of packed snow surfaces to extend effective runway lengths in winter.

The airport is equipped with a VOR/DME³ which allows non-precision instrument approaches, but even so, airport outages due to weather are reported to be a problem. The runway would in summer significantly constrain payloads on the Boeing 737, the most commonly used turbojet aircraft in the north. A minimum extension of 500 ft. would be desirable if that aircraft were to be placed into regular passenger service. An Instrument Landing System (ILS), or a Microwave Landing System (MLS) would normally be difficult to justify considering the low traffic volumes involved. However, the airport is alternate to several airports in the vicinity and, given that it is the main hub for the region, careful consideration should be given to improved electronic landing aids. This would be a particularly important consideration if corridor services were to be extended to Hall Beach which has a 5,400 ft. runway and currently accommodates Nordair B737 unit toll services. Hall Beach has a 5,400 ft. runway which regularly accommodates B737 flights. Non-precision instrument landing procedures similar to those at Rankin Inlet are in effect.

The other airports in the region operate at low traffic volumes which do not appear to justify the introduction of larger aircraft and associated airport expansion. Repulse Bay is a special case. It is the

3. VOR = VHF Omnidirectional Radio Range
DME = Distance Measuring Equipment
VHF = Very High Frequency

closest airport to Pelly Bay, a community completely supplied by air. An improved runway at Repulse Bay might be justified if that point were added to the NTCL resupply system and Hall Beach were not.

6. EVALUATION AND CONCLUSIONS

This chapter summarizes the conclusions from the analysis of present marine and air resupply operations. Based on these, it summarizes the opportunities which have been identified for retaining and expanding the resupply function of Churchill. It then evaluates the implications of implementing these opportunities and examines their sensitivity to various factors which might change the conclusions. Finally it discusses possible mechanisms and strategies for implementing the findings and presents an action plan.

6.1 SUMMARY OF CONCLUSIONS

The sections below summarize the present resupply operation, its problems and the opportunities for Churchill.

6.1.1 Existing Resupply Operation

The existing resupply operation from Churchill consists of the NTCL tug and barge service to the Keewatin, carrying 7,400 tonnes of dry cargo and 16,900 tonnes of fuel in 1984; the air cargo services transported an estimated 4,500 tonnes in the same year (about 30 percent delivered by unit toll carriers and 70 percent by charter). Not all of the Keewatin air cargo originated in or was handled from Churchill; small quantities were delivered from Thompson and some from Winnipeg direct.

6.1.2 Problems with Existing Resupply Operation

The problems with the existing resupply operation are:

- o the high cost of bulk fuel at Churchill - \$68 per tonne more expensive than at Montreal;
- o the cost of rail service from Winnipeg to Churchill at \$123 per tonne - a lower cost would attract some vessels from the Eastern Sealift to resupply through Churchill;

- o the level of service of the rail haul from Winnipeg to Churchill - reported delays of up to 10 days at system peak caused some shippers to use Thompson as an alternate origin for air resupply services;
- o the use of a flat rate for all NTCL cargoes regardless of distance leads to greater use of air service in the South Keewatin, resulting in under utilization of the NTCL service and hence marginally higher costs to the communities served.

6.1.3 Opportunities for Churchill

The opportunities for Churchill are:

- o to expand NTCL service to Hudson Strait, by charging at marginal rates, so as to be competitive with Eastern Sealift services despite the higher laid down cost of fuel and dry cargo at Churchill;
- o to attract some Eastern Arctic Sealift vessels and some private shippers such as Hudson's Bay Company to use Churchill as a resupply point for some of their cargoes, by upgrading the Winnipeg-Churchill land link and negotiating reduced rail tariffs;
- o to attract more cargo to NTCL from air service by introducing a distance-related tariff on the NTCL service;
- o to attract additional air cargo by the introduction of a Winnipeg-Churchill-Rankin Inlet-Hall Beach unit toll air service, which could later be extended to Nanisivik-Resolute;
- o to grant pick up rights at Churchill to NWT on their current non-stop service Winnipeg/Rankin Inlet or alternatively the northward extension of PWA service between Winnipeg and Churchill.

6.2 EVALUATION OF OPPORTUNITIES

The expansion of the resupply operation through Churchill poses a "chicken-and-egg" situation. Unless a Winnipeg-Churchill land link of lower cost and higher level of service can be established, significant new

resupply traffic cannot be attracted to the Port. However, unless significant new traffic is attracted, it is difficult to justify changes to reduce costs and improve service.

This chapter therefore examines the potential traffic for an expanded system (opportunity by opportunity), assuming that a satisfactory land link is established. It evaluates the relative attractiveness of different opportunities where they have overlap and develops a recommended list of options.

It then examines traffic volumes and requirements of the land link with these options, to evaluate whether the rate and level of service can be made attractive to the shippers.

The cargo volumes for each of the opportunities have been estimated in preceding sections of the report (in tonnes, based on estimated 1989 demand levels) as:

	<u>Dry Cargo</u>	<u>Fuel</u>
Existing Churchill Supply by Rail	3,400	
Existing NTCL Service	8,500	19,300
Existing Air Cargo	10,800	
Attraction of Montreal-Based Vessels	11,500	
Additional Air Cargo	<u>2,900</u>	<u> </u>
TOTAL	37,100	19,300

The total potential dry cargo volume for Churchill in 1989 is therefore estimated to be about 37,100 tonnes, versus about 22,700 tonnes if none of the proposed resupply initiatives were taken. The growth rate in demand between 1984 and 1989 is estimated at 2.7 percent per annum, based on the projected population growth rate as described in Chapter 2.

6.2.1 Expansion of NTCL v. Sealift Attraction

The expansion of NTCL territory brings both additional dry cargo and bulk fuel shipments¹ through the Port of Churchill whereas attracting Sealift vessels brings only dry cargo shipments. From this point of view, therefore, the expansion of NTCL is a preferred option. However, from a longer term point of view, it is probably a more vulnerable option.

Fuel is significantly more expensive in Churchill and should the drop in world oil prices be sustained (and assuming Montreal prices follow world prices) there may be strong pressure to supply the Keewatin with oil from Montreal. Since bulk fuel provides 73 percent of NTCL's cargo and almost 40 percent of its cargo revenue, it is doubtful that NTCL could continue to operate delivering dry cargo only. One report² has recommended that the NTCL operation be disbanded and the Keewatin be serviced from Montreal. While the analysis of the report has not been accepted by some organizations, the problem of high oil costs may ultimately lead to the result of a Montreal-based resupply operation. Attracting existing Sealift traffic to Churchill as a secondary resupply base (in addition to Montreal) would establish a mechanism for Keewatin dry cargo service to be maintained from Churchill should bulk fuel be supplied entirely from Montreal and NTCL's service as presently operated cease.

If NTCL traffic volume increases with population growth, the capacity to add new areas to the existing service diminishes with time. The additional Hudson Strait volumes amount to 25 percent of existing demand and correspond to nine years of growth from 1984 levels at the "baseline" growth rate. Moreover, the ability of NTCL to accommodate

1. Bulk fuel shipments provide negligible added value in the context of the Manitoba economy but do contribute to rail revenues which are a factor in negotiating lower rail tariffs.
2. Assessment of Northern Transportation Company Limited Keewatin Marine Operation and Alternative Service Options - TP4741E, Water Transportation Assistance Directorate, June 1983.

Hudson Strait traffic is based on the assumption of significant productivity increases in operation through use of local delivery personnel and through possible wharf construction at some outports as discussed earlier.

For the above reasons, full expansion of NTCL services is not proposed as a prime option, but one to be retained as a fall-back if attraction of Sealift vessels cannot be achieved. Extension to Hudson Strait Ports remains a primary consideration.

Apart from the linkage between fuel and dry cargo NTCL faces two other disadvantages: firstly, the majority opinion is that their present equipment is unsuitable for operating in the Foxe Basin, and secondly their fleet lies idle 75 percent of the time. NTCL might remain competitive if more suitable equipment could be brought in on a seasonal basis and used elsewhere in the off-season.

6.2.2 NTCL Distance-Related Tariff

An NTCL distance-related tariff (lower in the South and higher in the North) would be expected to divert cargoes from the air to the marine mode. In preceding sections, it is estimated that the potential for diversion is 1,000 tonnes, assuming that South Keewatin receives the same tonnes per capita by each mode as North Keewatin.

It would not be expected that the offsetting rate increase in the North would significantly affect the modal split there since the marine volumes throughout the Arctic are about 1.5 tonnes per capita everywhere other than South Keewatin despite large differences in marine distances and thus of marine costs.

This diversion, if achieved, would result in lower costs to Keewatin as a whole, since NTCL revenues would remain the same in total but air revenues would reduce, resulting in lower overall transport costs to customers.

A distance-related tariff by NTCL is therefore proposed. The new scale will need to be negotiated between NTCL and Transport Canada and included in the agreement between them. For evaluation purposes, cargo diversion to NTCL is estimated to reduce unit toll and charter air cargo volumes by 500 tonnes each.

6.2.3 Air Resupply Services

The geographical advantages offered by Winnipeg and Churchill for air resupply and air passenger travel to the Keewatin and other parts of the central Arctic are not being captured with the existing air route structure, which has north-south corridor services based mainly in Montreal and Edmonton. Improved air services in an expanded Winnipeg North corridor (Winnipeg-Churchill-Rankin Inlet-Hall Beach) would increase the competitiveness of Winnipeg based suppliers, particularly if the effectiveness of the land link to Churchill could be improved and rail rates lowered.

While the airport facilities at Churchill can accommodate expanded services (although an improved passenger terminal would be desirable) there is a growing likelihood that air cargoes to the North will be handled more and more out of Winnipeg or Thompson (because of their access by truck). The rail only access to Churchill means that dry goods (and bulk fuel) at Churchill are relatively expensive; there have also been problems of damage and loss reported by shippers and customers in the transshipment of goods from rail to the Port and to the airport at Churchill.

If Churchill is to retain and increase its role as an air resupply base, four important steps are required in addition to the expanded Winnipeg North air service:

1. Establishment of a lower cost road/rail link between Winnipeg and Churchill for dry goods, with lower rates

based on the higher volumes achievable from increased marine and air resupply services through Churchill as discussed earlier in Section 3.5 and earlier in this section;

2. Improved coordination for intermodal transfer at Churchill to reduce loss and damage;
3. Granting of passenger and cargo pick up rights at Churchill to the present non-stop air service between Winnipeg and Rankin Inlet.
4. Improved institutional arrangements so that customers in northern communities can deal with one resupply entity in ordering dry goods via the surface/air link through Churchill.

If these steps are taken, the lower cost surface/air link through Churchill can operate to the advantage of both Churchill and its northern customers. If not, then there is an increasing likelihood that Churchill's role as an air resupply base will be eroded in favour of direct air service from Winnipeg and Thompson.

6.2.4 Implications of Recommended Options

The estimated volume of dry cargo to be shipped to Churchill in 1989 for the recommended options is estimated to be about 37,100 tonnes as described earlier in this section:

Assuming 13.7 m (45 ft.) trailers, carrying average loads of 20 tonnes each, this would be equivalent to 1,850 trailers per year. Of these, 1,160 would move over the 13 week marine shipping season while the 690 associated with air resupply would move at a more uniform annual rate. In peak weeks, therefore, the demand could be for the equivalent of 100 trailers per week or 33 per passenger train, if all the general cargo were supplied using the passenger train thrice-weekly service. However, it is probable that even with an improved piggyback service, considerable cargo, particularly that shipped by Arctic Cooperatives Limited, would continue to move directly from Winnipeg in freight cars.

These volumes in total appear high enough that an increased service should be of interest to the railway especially since volumes are expected to continue growing at a rate of over 2 percent per annum to beyond 1989 in accordance with projected population growth.

6.3 SENSITIVITY TO OUTSIDE FACTORS

The tonnage forecasts are sensitive to a number of factors. Among these are:

- o attainment of the baseline forecast;
- o growth of cargo demand in proportion to population growth;
- o maintenance of the approximate 50/50 modal split between marine and air cargo; and
- o the continued price differential between Churchill and Montreal bulk fuel prices.

6.3.1 The Baseline Forecast

The baseline forecast assumes continuing population growth based on natural increase but no net migration. This is a conservative forecast in that net emigration appears unlikely but net immigration could occur if there were renewed mining activity or oil exploration. When Cullaton Mines was active in 1983, air cargo in Keewatin increased by about 3,000 tonnes. This represented an almost 50 percent increase in the air cargo levels of that time and represents almost 10 percent of the total Arctic resupply cargoes estimated in this report as potential to Churchill. Hence there is significant potential for traffic growth in the event of future resumption of mining activity within the region, with little prospect of lower rates of traffic growth (than those projected) because of the underlying demographics of the region's population. Appendix F provides a discussion of mining prospects in the study area.

6.3.2 Growth Proportional to Population Growth

It has been assumed in the forecasts that per capita demand for bulk fuel and dry cargo will remain constant and consequently that cargo growth will be proportional to population growth. It is possible there will be further conservation in fuel consumption, reducing the estimated demand, but there is no obvious factor which would lessen the demand for cargo on a per capita basis. Significant reductions in per capita fuel consumption (e.g., by more than 5 or 10 percent) are considered very unlikely since the impacts of high oil prices, in terms of conservation, have already been felt; indeed recent dramatic decreases in world oil prices and the anticipated lack of pressure for major price increases during the next five or ten years suggest that it would be more likely for per capita fuel consumption to increase rather than decrease over this period.

6.3.3 Modal Split

The air mode had been gaining an increasing share of the resupply market until the NTCL effort restored the marine share in 1984 and held on to much of the gain in 1985. It is possible that air resupply might resume its increasing share in future, in which case the air cargoes would increase above those projected and the marine cargoes would be reduced.

It is therefore important from a strategic point of view to press for traffic for both the air and marine modes through Churchill so as to retain traffic for the community and for Manitoba, regardless of which mode becomes dominant.

6.3.4 Churchill/Montreal Oil Price Differential

The unattractiveness of Churchill as a bulk fuel resupply port lies in its high cost of supply overland by rail. Before 1979, fuel was supplied by tanker from offshore refineries. The study has not identified

a potential offshore source who would be interested in supplying Churchill at a price equal to or marginally above the Montreal price but this option should be pursued. The fuel storage facility at Churchill is presently leased by Esso until 1989 but fuel is contracted for on a yearly basis.

The oil market is at present very volatile and the opportunity for offshore oil supply could arise again. Should a potential offshore supplier be identified, the oil resupply market of Hudson Bay and Hudson Strait (amounting to 75,000 tonnes of fuel in 1989) could become an economically viable movement through Churchill. In this regard, the MV Arctic is being further ice strengthened (to a class 4 icebreaker) and reconfigured, with work to be completed by May 1986. We understand that its new configuration provides capacity for 20,000 tonnes of fuel or a similar capacity of 20-25,000 tonnes of grain. This offers the potential for bringing in bulk fuel to Churchill and taking grain out which, because of the backhaul, would increase the economic viability of reestablishing the marine delivery of fuel to Churchill and a consequent reduction of fuel prices both for use locally and as a resupply cargo for communities to the North.

6.4 MECHANISMS AND STRATEGIES FOR IMPLEMENTATION

To achieve the increased flow of resupply cargoes through Churchill in accordance with the opportunities described earlier, two changes have to occur simultaneously:

- o the scope of Sealift operations would have to be expanded to include ordering some shipments through Churchill rather than through Montreal; and
- o the railway would have to offer a lower cost freight service from Winnipeg to Churchill both for direct freight and for piggyback shipments via Thompson.

The encouragement of private marine shippers and the encouragement of increased air shipment from Churchill, rather than from Thompson or

from Winnipeg directly, would then follow. An airline would have to be interested in the Winnipeg North air service and supported in seeking a regulatory change to obtain rights to fly this route.

6.4.1 Sealift Via Churchill

The Sealift ordering and resupply process is a cooperative one coordinated by the Canadian Coast Guard. It has been proposed that the Government of the Northwest Territories might set up a branch or an agency to take over the coordination function from the Coast Guard in fiscal year 1987/88. Whether this new agency coordinates the Sealift activity or not, for Churchill to be included in the system it would be necessary for the customers to guarantee minimum levels of shipments through the Port. If it were agreed to include Churchill, the Coordinator could call for bids from vessel owners to make an initial voyage carrying Montreal or Ogdensburg originating cargoes, followed by voyages to Churchill to pick up supplies for Foxe Basin, Hudson Strait and possibly Frobisher Bay before returning to Eastern Canada. Montreal originating cargo bound for NTCL-served ports could also be transshipped at Churchill, thereby bypassing the rail system and reducing transportation costs.

It may be appropriate for the Province of Manitoba to take a more direct interest in the Eastern Arctic Sealift coordination functions, since it is in Manitoba's interest to encourage the use of goods purchased in Winnipeg for Arctic resupply. Possibly a joint NWT-Manitoba Coordinating Committee could be established whereby Manitoba could assist and support the NWT Government and the major shippers in formulating strategies and objectives for improving the services in the corridor and in rate negotiations with the railway, forwarders and trucking companies.

6.4.2 The Rail Link

To achieve lower rates on the road/rail link from Winnipeg to Churchill, CN would have to offer a service designed for the higher volumes. Given the fact of only once a week freight service from Winnipeg,

the Winnipeg-Thompson road link plus a transfer onto cars designed to receive trailers easily for shipment with the passenger trains appears to be the practical solution. At Churchill the trailers would either be transferred to the wharf directly (as desired by some of the shippers), off-loaded for transshipment in palletized form or driven to the airport for air cargo resupply.

The railway will probably require some guarantees of minimum annual volumes and ceilings on peaks in order to make the necessary commitments and to introduce a reduced rate. Such guarantees might be given by the Province of Manitoba, based on the NTCL, Sealift and Town of Churchill known minimum requirements and the committed cargoes of Arctic Cooperatives Limited and the Hudson's Bay Company.

6.4.3 Other Marine Shippers

The Hudson's Bay Company and Arctic Cooperatives Limited have indicated a strong interest in shipping through Churchill. These shippers could well be included in the Sealift coordination function. They may be willing to give commitments on quantities to be shipped as part of any rail rate guarantee that may be required.

6.4.4 Expansion of the Winnipeg North Air Link

The air route north from Churchill has relatively low passenger volumes. Moreover, in seeking access to Hall Beach, Nanisivik and Resolute, the new service would be in competition with Nordair which serves these points out of Montreal. The presence of air cargo via Churchill may therefore be a significant factor in providing revenue to the proposed route for its initial and subsequent operations. For this cargo to be of benefit however, it would have to be accessible to the air carriers operating north of Churchill to Rankin Inlet and Hall Beach. The establishment of the Winnipeg North air link would thus logically follow the establishment of a reliable higher volume land link based on marine cargoes. The

potential for increased uniform year-round demand for air cargo would also be of potential interest to the railway since it would allow more effective utilization of committed rolling stock.

6.4.5 Coordination of Air Cargo

An Arctic customer has to choose between receiving an item in the once-a-year marine resupply operation or else by the next available airplane. The option of a reliable overland cargo service to Churchill and then supply by airplane would, however, offer services within a few days and would be adequate for all but the most urgent requirements. For this service to offer an acceptable level of service it would need to be marketed by an organization which would coordinate the land/air system so that a potential customer could call a single agency in making his shipment. This coordination function could be provided by a freight forwarder, by the airline in coordination with the railway, or initially by an agency contracted by either the North West Territorial Government or the Province of Manitoba.

At present there are two air carriers in the Central corridor who might benefit from a more competitive environment. Pacific Western operates a Winnipeg-Churchill service and serves Resolute from Edmonton and Cambridge Bay. Northwest Territorial operates the Winnipeg-Rankin Inlet link and also serves Hall Beach from Edmonton and Cambridge Bay. The Winnipeg North corridor extension would result in competition with the carriers providing existing service in these corridors from Edmonton and the West which tie into the national airline networks. However, these airlines, with their Western bases appear to be logical contenders for the additional landing rights. Calm Air, headquartered in Thompson and serving Keewatin, would be an alternative, but it would face competition from Pacific Western on the Winnipeg-Churchill leg and from Northwest Territorial on the Winnipeg-Rankin Inlet leg and this would pit a small airline with unsuitable aircraft against two larger ones on the highest volume sector of the route.

It is proposed that the CTC carry out a detailed assessment of the route extensions proposed in this study taking into account the potential for increased cargo flows resulting from an improved and cheaper rail service to Churchill. This assessment should involve both the carriers and the NWT Government. It is suggested that these discussions be held after the prospect for a restructured Sealift and Churchill resupply land link have been clarified, but not necessarily finalized.

6.5 SUMMARY: PROPOSED ACTION PLAN

Based on the above conclusions and recommended strategies for preserving and expanding rail, marine and air resupply operations through Churchill, the following action plan is proposed:

1. The Government of the Northwest Territories should discuss with the Canadian Coast Guard the economic advantages of interim calls by Montreal-based Sealift vessels at Churchill to pick up new supplies for Arctic communities rather than returning directly to Montreal. Under this arrangement, a vessel would leave Montreal, deliver its first cargoes (for example to communities in Arctic Quebec and Hudson Strait), pick up new supplies at Churchill and resupply another set of Arctic communities, repeat this sequence a second and possibly a third time, and then proceed back to Montreal at the end of the season. The sailing time and costs saved by using Churchill as a secondary base in this manner would offset the additional price of commodities at Churchill, provided that reduced rail and truck rates could be negotiated (based on the increased volumes) in line with similar rail/truck rates offered on northern routes in other parts of Canada. The objective of these discussions would be to achieve an agreement by the Canadian Coast Guard and the users of the Sealift service to use Churchill as a secondary resupply base in this manner provided that appropriate rail and road rates from Winnipeg to Churchill can be achieved.
2. In parallel with Step 1, the NWT Government supported by the federal and Manitoba governments and the major shippers should enter into negotiations with CN and appropriate trucking firms with the objective of

achieving increased service and reduced rates overland from Winnipeg to Churchill, reflecting the increased volumes achievable from Step 1 and from increased air resupply activities through Churchill (see Step 5 below). It may be that guarantees of minimum annual volumes will have to be made in accordance with these negotiations.

3. The Government of the Northwest Territories and Transport Canada should enter into discussions with NTCL regarding expanded NTCL resupply operations (e.g. to include communities at the eastern end of Hudson Strait, and/or the east side of Hudson Bay). While the alternative of using Churchill as a secondary resupply base for the Eastern Arctic Sealift is considered to be a better overall strategy than attempting to expand NTCL's resupply operations because, as described earlier, it is less vulnerable to economic pressures to supply bulk fuel to Keewatin through Montreal in the context of declining world oil prices, the NTCL system does have surplus capacity which should be utilized if possible at least as long as the present contract remains in force.
4. The NWT Government and the Manitoba Government should jointly examine the desirability of establishing a committee to determine the preferred strategy to be followed in improving the service of greatest interest to Manitoba in the context of increased resupply shipments from the province. This committee, when appropriate, could be expanded to include the major shippers and representatives of other agencies or boards having a direct interest in increasing resupply traffic through Churchill.
5. The Government of the Northwest Territories should discuss with the Manitoba Government and the CTC the need to improve air service in the Central corridor including the granting of pick up rights at Churchill for the direct Winnipeg-Rankin Inlet air service and the extension of that direct service northward from Rankin Inlet to Hall Beach. This discussion should take into account the potential for increased air cargo traffic arising from Step 2.
6. The Government of the Northwest Territories with the support of the appropriate federal government agencies, and in cooperation with the shippers and air carriers, should establish the minimum level of unit toll cargoes required to support unit toll passenger operation. A tendering and contracting mechanism should then be

developed to allow the remaining cargoes to be handled by charter carriers on the basis of competitive tenders taking into account both the tariffs paid and the levels of service offered.

7. The possibility should also be explored of having the Coordination of the road/rail/air cargo movements carried out by one or more private companies either as a private consortium or in a private/public consortium. The various levels of government involved could cooperate in providing the policy framework and information support and the private company or companies could provide the day-to-day operations.
8. NTCL and Transport Canada should enter into negotiations aimed at achieving a distance-based resupply tariff for NTCL which would provide somewhat lower marine rates to the Southern Keewatin communities and somewhat higher marine rates to those in the North Keewatin. This would result in lower resupply costs to the Keewatin as a whole since NTCL revenues would remain the same in total but air revenues would reduce reflecting a shift from air to marine resupply of South Keewatin communities.

If the recommended action plan is followed and successfully achieved there would be a number of benefits to the economies of the study area, Manitoba, Winnipeg and Churchill resulting from the additional tonnages of dry cargo for Arctic resupply to be shipped through Churchill. These would amount to an estimated 14,300 tonnes per year in 1989 (11,400 tonnes through the proposed use of Churchill as a secondary resupply base for the Eastern Arctic Sealift and 2,900 tonnes of additional air cargo carried by the proposed Winnipeg North air service. In addition Churchill would be handling the existing resupply volumes (7,400 tonnes by NTCL, 3,000 tonnes of Churchill supplies and 8,000 tonnes of existing air cargo or 18,400 tonnes in total) which would amount to an estimated 21,000 tonnes by 1989.

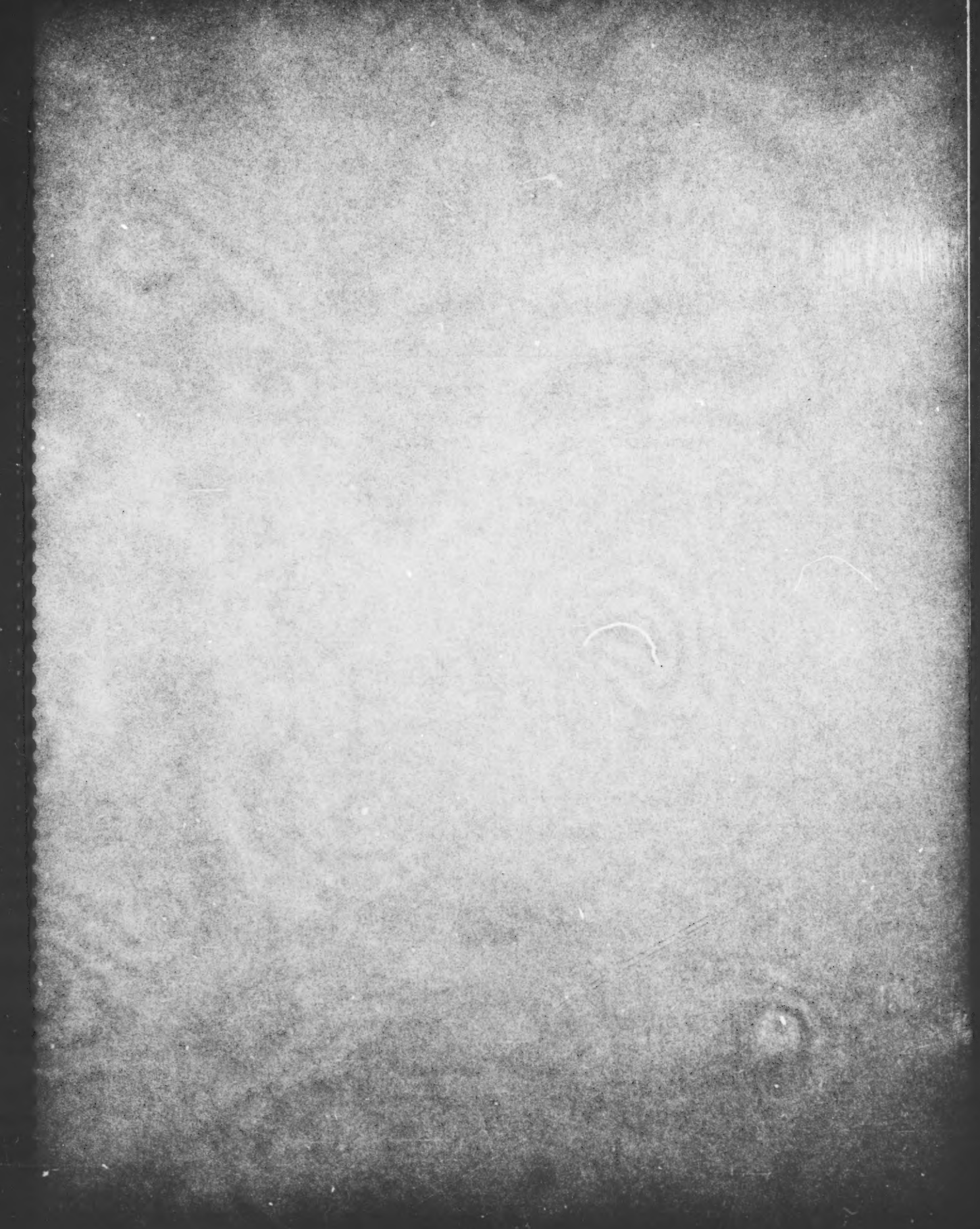
The additional 14,300 tonnes per year would produce an estimated 245 additional person years of employment in and around Churchill and Winnipeg and additional annual labour income of about \$4.5 million in those communities, taking into account direct job and income effects and

indirect/induced effects as reflected in employment and income multipliers for the Province of Manitoba. The direct jobs and income would be produced chiefly in the following activities: palletizing and shiploading operations at Churchill, trucking between Winnipeg and Thompson, and food processing and wholesaling in Winnipeg.

Largely offsetting these benefits would be the impact of the reduced marine resupply volumes through Montreal (an estimated loss of about 11,000 tonnes per year in 1989) and reduced air cargo volumes through Montreal (an estimated loss of about 2,500 tonnes per year in 1989) or about 13,500 tonnes in total. This would lead to an estimated loss of about 240 person years of employment and \$4 million dollars of labour income per year in the Province of Quebec. Similarly, there would be marginal losses of jobs and income in Alberta owing to some losses in air cargo resupply volumes, estimated at about 5 percent of the losses in Quebec. However, by allowing Quebec operating marine cargoes to be transshipped at Churchill, ports in the Keewatin which are currently closed to Quebec vessels could be served by Quebec suppliers.

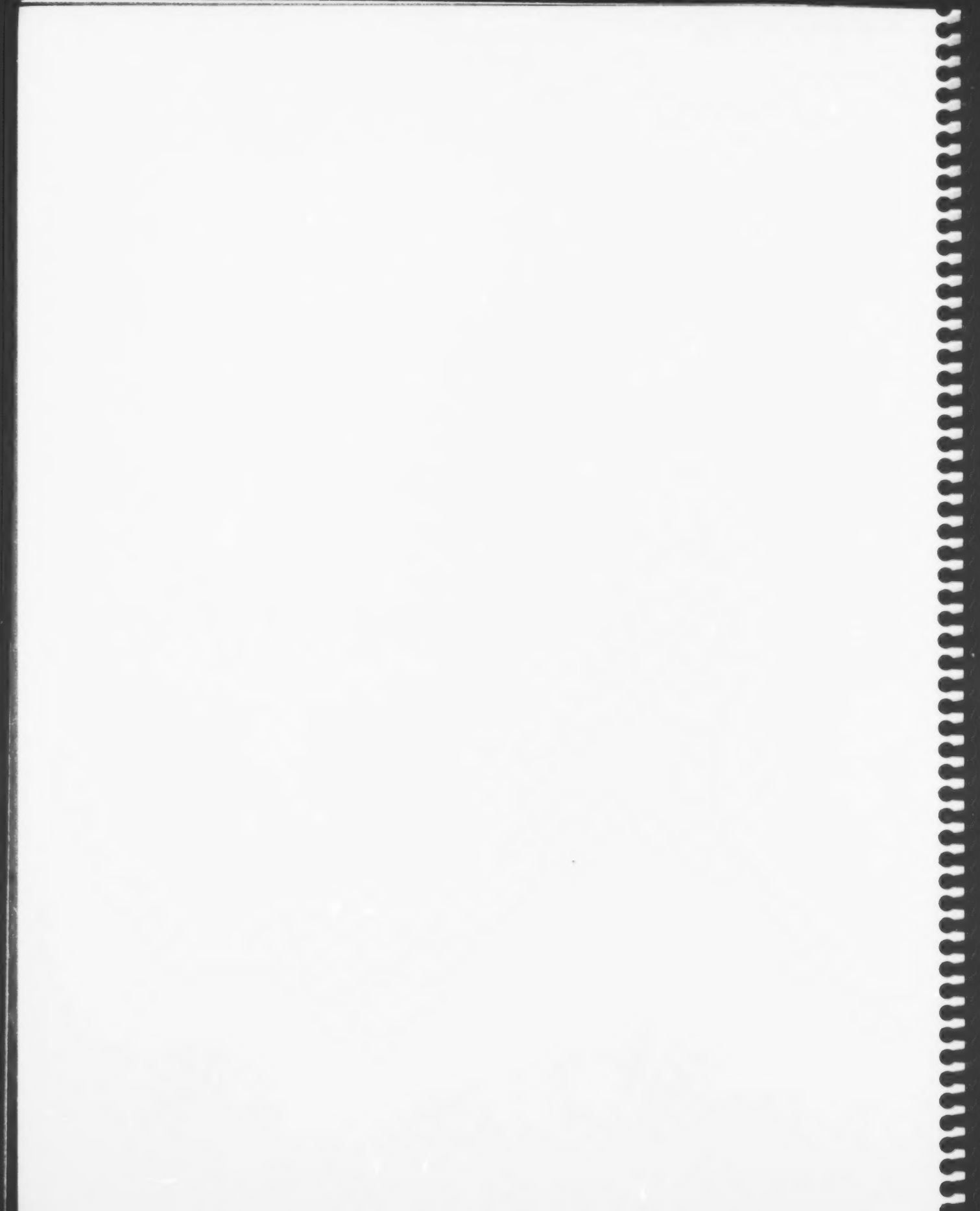
There would be an overall economic benefit to the six Keewatin communities currently served by NTCL which would, in total, pay lower resupply rates, assuming a reduction in CN tariffs. Similarly, the other communities served by the Eastern Arctic Sealift would also pay slightly lower resupply rates because of the cost savings of using Churchill as a secondary resupply base. The economic impacts of these reductions are difficult to quantify in terms of jobs and income, but the reduced resupply rates would no doubt be appreciated by the Arctic communities involved. The three Northern Keewatin communities would experience a slight increase in marine resupply rates relative to those to the Southern Keewatin if tapered marine rates were introduced but this would tend to be offset by improved air cargo and passenger services made possible by the improvements proposed for the rail system and the restructuring of air services in the Central corridor.

In summary, the recommended action plan, if achieved, would lead to marginal increases in jobs and income in Manitoba which would be largely offset by smaller decreases of jobs and income in the Montreal and Edmonton regions. More importantly, the new services would produce a net reduction in both marine and air resupply rates as experienced in most Arctic communities in the study area. Substantially improved air services for resupply cargoes (and for passengers if a combined cargo/passenger service is provided) would also be achieved in the corridor north of Churchill, serving Rankin Inlet and Hall Beach directly and, Nanisivik and Resolute by connecting flights. The communities north of Churchill would experience a substantial increase in convenience and reduction in cost for air service to the nearest communities lying south of them, e.g. Churchill and Winnipeg. A related, less tangible benefit would be a strengthening of the resupply role of Churchill and therefore of its viability as a strategic centre to help achieve other sovereignty, defence and economic objectives in Canada's North.



APPENDIX A

CHURCHILL - RESUPPLY BASE



APPENDIX A

CHURCHILL - RESUPPLY BASE

1. FACILITIES

Churchill, Manitoba, is the only community on the west side of Hudson Bay with a direct land transportation link with southern Canada. As such, it serves as a focal point for supplying goods (and services) to the remaining communities on the west coast of the bay. The majority of goods are transported via rail to the town of Churchill, where they are sorted and transshipped by air or by sea to the receiving ports.

On the marine side virtually all goods are transported by a single operator, the Northern Transportation Company Limited (NTCL), with headquarters in Edmonton, Alberta. NTCL operates shipping terminals in six communities in the Western Arctic and Alberta, and one community, Churchill, in Manitoba. From Churchill six settlements are served at the present time by the NTCL operation. They are Eskimo Point, Whale Cave, Rankin Inlet and Chesterfield Inlet on the west coast of Hudson Bay; Baker Lake, 300km inland up Chesterfield Inlet on the west shore of Hudson Bay; and Coral Harbour, located on the south shore of Southampton Island.

Churchill is located at 58 degrees, 47'N and 94 degrees, 12'W, at the mouth of the Churchill River on the west coast of Hudson Bay, as shown in Exhibit A-1.

Churchill harbour is located in the mouth of the river and is bordered on the east by a rocky peninsula, tapering to a blunt point at Cape Merry, and on the west by another rocky peninsula surmounted by Fort Prince of Wales.

1.1 Navigation

Navigation aids are the responsibility of the Canadian Coast Guard; at Churchill these facilities are maintained by Ports Canada on a cost recovery basis.

A lighted fairway buoy, fitted with a bell and radar reflector, is positioned 7.0 kilometres northeast of the harbour entrance. The entrance and fairway through the harbour and the turning basin are marked by lighted buoys. The shoal, 0.2 miles NNW of Cape Merry, is marked by a similar buoy as well as a bell.

Three sets of light ranges are located onshore on the west side of the river to facilitate entering the harbour.

Pilotage is compulsory for merchant ships entering or shifting berth in the harbour. In general, the pilot is transferred near the fairway buoy from the harbour tug, the W.N. Twolan. Helicopter transfer is available for late season pilotage, as was required by the M.V. Arctic. However, the resupply tug, the M.V. Keewatin, does not use the services of a pilot as the crew are very familiar with the harbour.

There is a small anchorage within the Harbour but it is recommended that large vessels anchor one to three miles northwest to northeast of the fairway buoy.

The Canadian Hydrographic Service Sailing Directions report that there are three marine/air radio beacons at Churchill. The most powerful is located 12 kilometres east of the Harbour; the second is close to the east of the harbour, and the third lies 9.6 kilometres SSW of the first.

1.2. Harbour

The harbour entrance channel northwest of Cape Merry has a low water depth up to 21 metres and a width of approximately 350 metres; this area is subjected to high currents of about two knots on the flood tide and up to five knots on the ebb tide. Further upstream the river widens substantially. At a point just south of the main wharf the river is 2.4 kilometres wide and has a maximum natural depth of about 4.3 metres. The navigation channel width varies from 350 metres at the entrance of the harbour to 200 metres just north of the main wharf. A major dredging program was completed in 1980, providing a minimum draft of 9.2 metres at low tide. An annual sounding surveying program is being carried out as part of a sedimentation study by a Vancouver consultant studying the effects of the 1980 river diversion for the Nelson River power project. The berths alongside the loading gallery were overdredged to 11.6 metres to provide additional draft. This facilitated the topping up of vessels at any tide, so that a vessel is not restricted to complete loading and leave the harbour on the same high tide. However, the recent sounding survey indicates sedimentation has taken place and this operation is no longer possible for the deeper draft vessels.

The 1980 charted dredge depths are as follows:

The 168m general cargo berth at the north end of the wharf was dredged to 10.6m; the central 240 metres of the grain loading berths were dredged to 11.6m; the remaining length of wharf was dredged to 10.0m, with a narrow area adjacent to the wharf face 10 metres wide, dredged to a depth of between 8.5 and 9.8 metres. This berm against the timber crib wharf was created to ensure against undermining. The original 1980 dredging program was to dredge this area down to 11.6 metres. However, during the

exhibit A-1

CHURCHILL STUDY AREA



dredging program it was discovered that dredging to such a depth would undermine this portion of the wharf.

The wharf has an overall length of 843 metres with a width of 91 metres at the north end. There is water access on all four sides of the structure, providing the following berthing arrangements: on the west face are three grain berths, Berth No. 1, No. 2 and No. 3, and two general or bulk cargo berths, Dalglish at the north end and Wolf at the south (see Exhibit A-2). The north face is usually used by the resupply barges for loading bulk fuels; the east face behind the wharf is used for loading the resupply barges as well as being used for the winter berths; and the south face is used for berthing smaller tugs and work boats.

The southern 230 metre portion of the wharf is connected to shore and the elevator by an earthen causeway. This approach is used for all access to the wharf and is traversed by rail line, roadways and grain conveyor from the elevator.

The elevator machine shop and power house and the Arctic Grain Company pelletizing plant are also located on the causeway. The roads and rail line run the length of the wharf. Other buildings on the wharf are the transit shed, water pumphouse, which is at the south end of the wharf, and a small office complex for the various operations and officials of the port (see Exhibit A-3).

At the north end of the wharf a slip is provided on the east face, between the wharf and shore. The slip is approximately 34 metres wide at the entrance between the wharf wall and the old marine railway pier, and runs 600 metres south to the gallery conveyor causeway. The water depth varies from approximately -2 metres to +1 metre¹ at the south end. The portion of the wharf adjacent to the pier shed is used for the resupply barge loading operation.

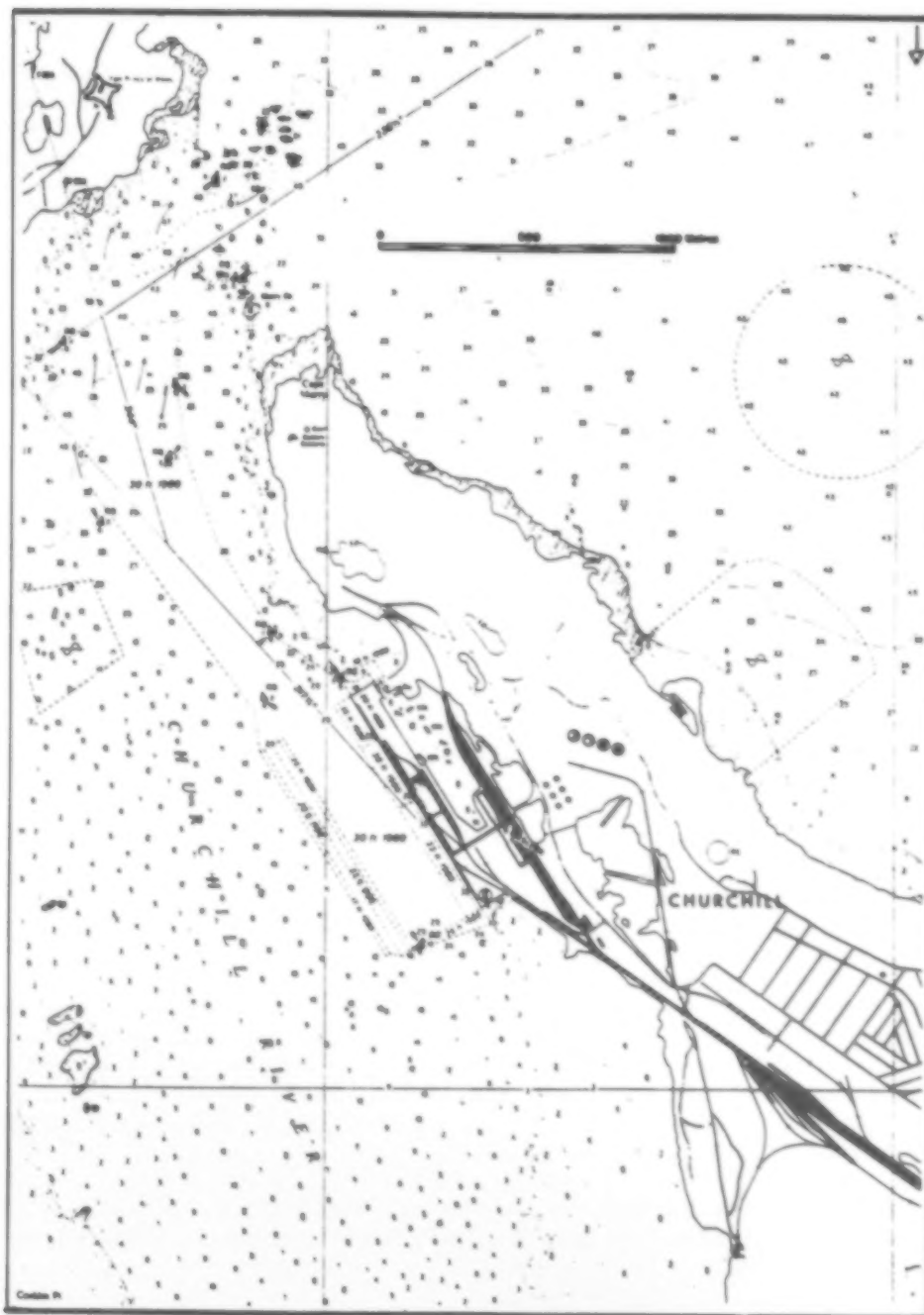
The inner basin or berth is formed by an earth dike extending from shore across to the wharf just north of the transit shed, the south end being sealed by the causeway. The berth is approximately 260 metres long, along the wharf wall, and 110 metres wide along the dike. An access road to the basin bottom is located on the east or shore side of the basin. In 1978 concrete pads and pedestals were constructed on the basin bottom to facilitate repair work and inspection of the barges and tug as required. The dike is fitted with a culvert and gate to empty the basin; a small amount of water is usually in the basin over the winter (largely due to seepage). A yearly operation to break the vessels from the ice is required in the spring, using backhoes and other equipment.

The outer basin is formed by a second dike located some 150 metres further north.

¹ Depths quoted are at Low Water Ordinary Spring tide (LWOST) which is also the Chart Datum.

exhibit A-2

CHURCHILL HARBOUR



1.3 Wharf

The main wharf is owned by Ports Canada and is used by Ports Canada and Northern Transportation Company Limited. Occasionally, other space is leased to temporary or seasonal operators and shippers as necessary.

The original or old wharf was constructed in 1929-1930 after the rail line to Churchill was constructed in 1928. The wharf was originally 518 metres long and in 1961 was extended at the north and south ends 168 metres and 157 metres respectively for handling general and other cargos.

The wharf is constructed of rock ballasted timber cribs and on the breasting face the cribs are 14.9 metres wide at the base by either 30.5 or 47 metres in length by 17 metres high. The cribs are constructed of 300x300mm treated B.C. Fir and on the front, or berthing face, an additional layer of timber is placed, providing a double wall. Another layer of timber planking is secured to the face, providing a replaceable wear surface. These planks are annually repaired or replaced because of ice damage. The berthing face is sloped 12:1. A timber curb is located on the outer face of the cribwork.

A second series of timber cribs is located on the inside edge of the wharf north of the conveyor causeway. These cribs are somewhat smaller than the breasting face cribwork. They vary from 7.3 metres to 9.8 metres in width and are 30.5 metres long and built to a height of 5.8 metres.

At the south end of the winter berths, the wall is constructed of steel sheet piles with a concrete cope beam. The length of wall is approximately 115 metres.

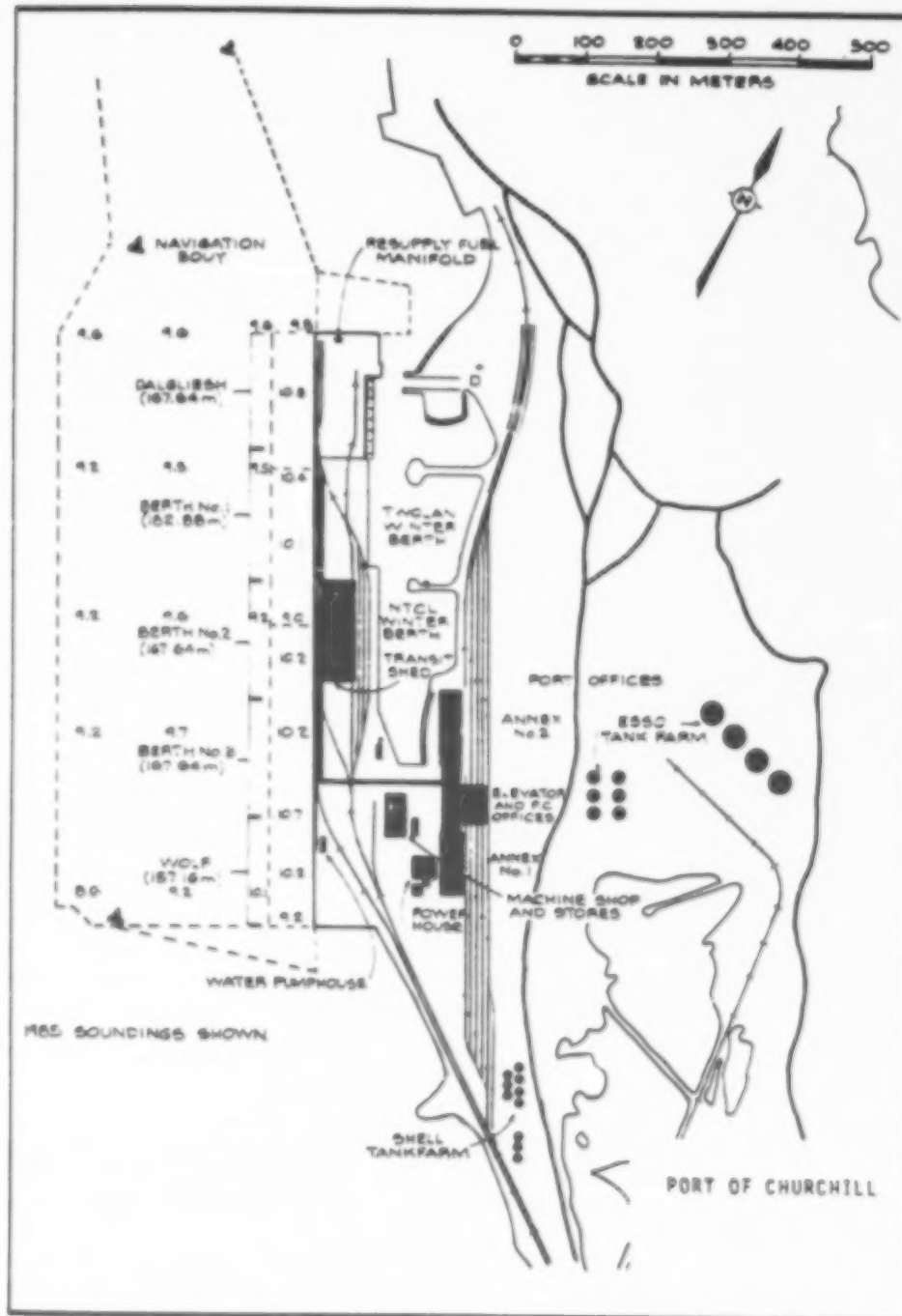
1.4 Wharf Facilities

The wharf has a surface area of 7.26 hectares, of which there are approximately 4.0 hectares available for open storage, the main area being to the north of the transit shed (see Exhibit A-4).

The wharf is traversed by two groups of rail tracks running from the south - one group up the main wharf face under the loading gallery, and the other set running by the east side, into the transit shed, and continuing almost to the north end of the wharf. The rail lines are in poor to fair condition. The apparently unused line along the wharf west edge is in very poor condition.

The majority of the wharf and approaches are gravel surfaced and there is one loading-unloading ramp for rail cars located outside, north of the transit shed.

PORT OF CHURCHILL EXISTING CONDITIONS



The wharf area is supplied with 550 volt power and is well lighted for night work by the high-level, high pressure sodium lights recently installed.

Two waterlines, 400mm diameter and 457mm diameter respectively, traverse the wharf from the elevator powerhouse to a pumphouse at the south end of the wharf to supply vessels with fresh water.

Fuel and petroleum products for resupply are transferred via a series of pipelines running from the Esso tank farm east of the elevators along the railway berm, then underground to the south end of the wharf, up the east face and across the wharf to an underground header, at about midway across the wharf on the north face. There are two 100mm and one 150mm pipelines serving the dock at this time. It is noted, however, that the facility is no longer equipped to receive product, but could be with minor changes.

Vessels are usually refueled from tanker trucks at the southern end of the wharf. Only diesel fuel is available for bunkering; there is no regular supply of the heavy fuels for ocean-going vessels.

1.5 Adjacent Land Areas

The land immediately north of the wharf is owned by Ports Canada and the main portion of Cape Merry Peninsula north of the Ports Canada property is owned by Parks Canada and contains some historic monuments.

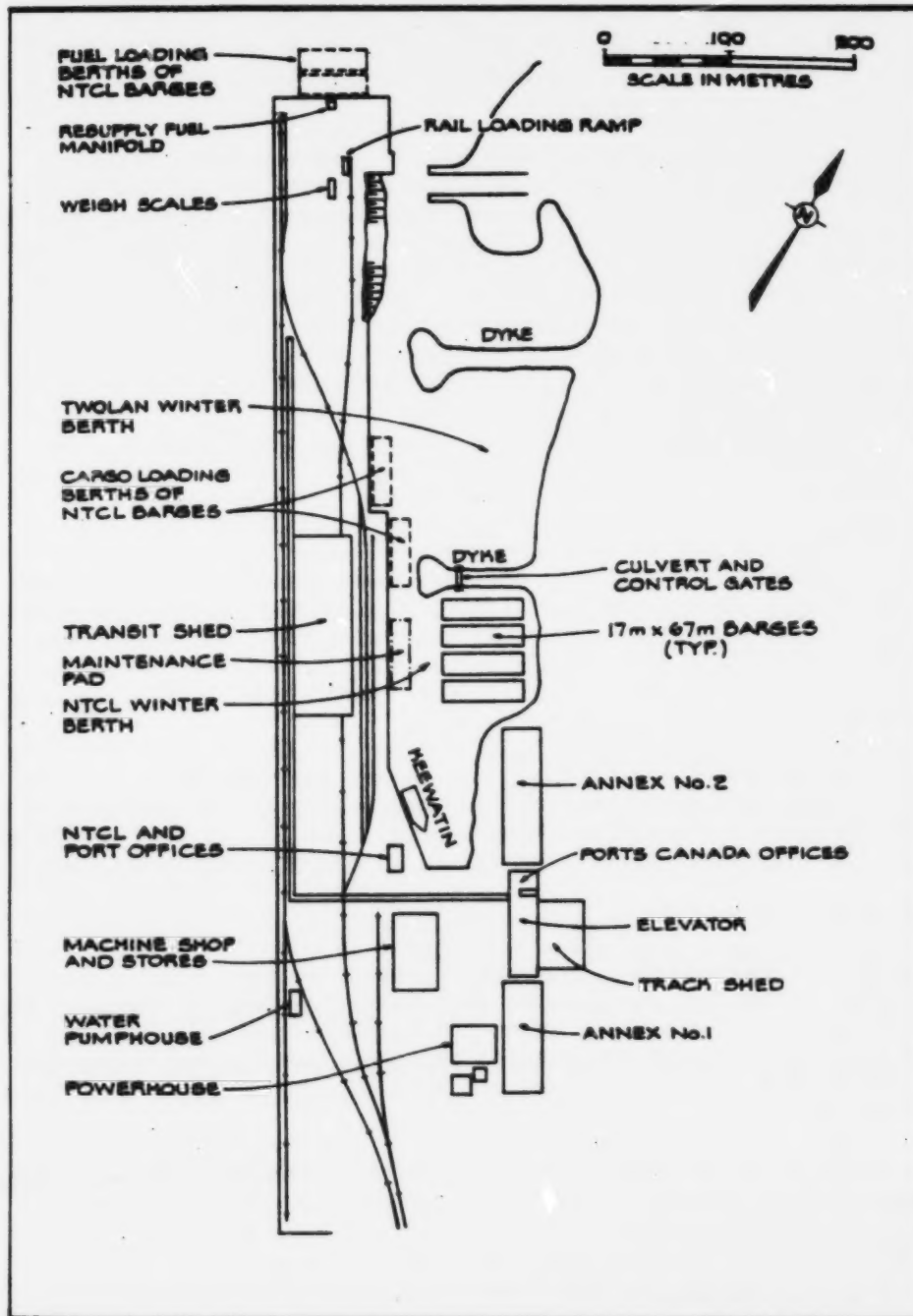
The waterway immediately north of the wharf is used primarily by the resupply barges for receiving fuel. The channel is 74 metres wide and the south half of the channel was dredged to 6 metres and the remainder to 3 metres in 1980.

The remaining 116 metre long area on the east side of the wharf just north of the "old wharf" consists of a rubble embankment.

North of the channel is an area of tidal flats rising up a sandy beach towards shore. The flood zone represents an area of 5.2 hectares, running north 315 metres from the wharf end to the Cape Merry Peninsula, and east from the face projection to the rail lines. This 5.2 hectares represents reclaimable land, excluding the channel and winter berth areas. The water depth ranges from 0 to 7 metres above LWOST.

The area south of the Churchill wharf also consists of tidal flats. They extend from the wharf's edge upstream at least 10km, and they vary in width from 60 metres just south of the wharf up to 500 metres further upstream. The limit of this area is bounded on the northeast by the railway track berm and bounded on the east by the flats area of the town of Churchill.

PORT OF CHURCHILL: DETAILS



The available area within 500 metres of the wharf is about 9 hectares, but could conceivably extend up to 70 hectares if it were possible to include all the tidal flats area 1.5 kilometres south of the wharf. The elevation varies from 0 to 6 metres above LWOST at the rail lines on the east edge of the site.

1.6 Covered Storage

A steel framed and clad transit shed is located midway along the wharf. It provides approximately 7,973 square metres of covered storage, of which some 5,574 square metres are divided and leased to NTCL. The facility is lighted but not heated or insulated, and is equipped with a new sprinkler system. A rail spur enters the shed from the south and runs the length of the shed along the east wall. Box cars are unloaded directly from the door level floor inside the shed. NTCL has installed their own shrink wrap machines, repair shop, etc. Access to the wharf is through either end of the shed. The shed is well maintained and in relatively good condition.

1.7 Repair Facilities

A complete machine shop is located on the causeway to the wharf, which is used primarily to service the elevator equipment. All the facilities are available for marine work and repair and have been used quite extensively. In fact, the port aluminum work boat was fabricated here. The equipment includes: MIG welder; full range of electric arc and oxyacetylene welding and cutting equipment; full range of machining equipment - lathe, milling machine, presses; a 5mm plate bender, etc., as well as a small quantity of light steel plate in stores.

Ports Canada staff report that, for all of the vessels which have visited the Port over the years and have suffered ice damage the repairs carried out, although temporary, have always been sufficient to allow the vessel to take on its full load of grain and depart.

1.8 Grain Facilities

The dock is served via a four-belt conveyor system, running from the elevator across the causeway to the loading gallery on the west face of the wharf. The gallery spans the length of the original 1931 wharf and has 23 loading spouts serving the three main berths. The shipping capacity is about 1,200 tonnes per hour (45,000 bushels) from the four conveyors.

The grain elevator terminal consists of a workhouse with two storage annexes of 100 bins.

The grain capacity is 1,633 tonnes per hour (60,000 bushels), with four shipping scales and four conveyors. The practical working capacity is 75% of the design capacity and a cleaning capacity of 850 (30,000 bushels) per hour.

Screenings and reclaimed grain dust are processed into pellets by a plant operated in the elevator powerhouse. The pelletizing plant is operated by Arctic Grain Co.

The elevator is connected to the grain berths by a 1,460 foot conveyor. Of the twenty-three spouts, four would normally serve one vessel, one from each conveyor belt.

1.9 Petroleum Facilities

Esso maintains a terminal which is the only significant shipper of petroleum products over the wharf. Esso owns and operates the tank farm, which is located immediately east of the elevator on about 10.5 hectares leased from Ports Canada. The other oil company presently in town is Shell, which competes with Esso for the local fuel requirements and fueling tugs and resupply vessels.

Currently, all product is received by rail, but prior to 1980 overseas products were received by vessel. The diesel supply lines to the dock are two 100mm lines and one 150mm line running north of the elevator and to an underground header at the north end of the wharf about midway across the wharf. These supply fuel products for shipment to the resupply ports. Bunkering is done by tank truck directly at the wharf.

The tank farm facilities include four diesel storage tanks with a capacity of 40,000,000 litres; three gasoline tanks with total storage of 4,000,000 litres; one diesel (dyed) storage tank of 2,300,000 litres, and one tank for Turbo B with a capacity of 1,430,000 litres. In 1985 about 20,000,000 litres of product will be used.

There were four large 200mm lines running to the wharf face that were used to receive and ship product but these have since been removed.

1.10 Ports Canada Equipment

Vessel handling and cargo handling equipment owned by Ports Canada at the port includes:

Floating Plant

- (a) The tug "W.N. Twolan", built in 1962 in Lauzon, Quebec, 29 metres long and 299 gross tons, twin screw, single rudder, equipped with two 760 HP diesel engines, two fire-fighting monitors, ice reinforced hull for ocean travel, and accommodation for 8 crew.

- (b) The tug "George Kydd", built in 1960 in Owen Sound, Ontario, 13.1 metres long, steel hull at 21 gross tonnage, 600 HP diesel engine for harbour use only.
- (c) A new 6 metre aluminum boat, with 110 HP outboard motor, used for sounding work.
- (d) A twelve-section flexi float assembly barge, total size 9.1 metres by 39.6 metres.

Onshore Equipment

- (a) A 90 tonne crawler crane with 36 metre boom and 9 metre jib boom, complete with attachments and drum laggings for crane, clam and drag work. A 90 tonne hook block is included, although taper tip boom is maximum rated at 69.8 tonnes.
- (b) One Dominion 550, 51 tonne crawler crane with 24 metre boom, complete with attachments and buckets for crane, clam and drag work.
- (c) Two gas powered Plymouth locomotives used for rail switching throughout the area.
- (d) One 5-ton truck; 9 1/2-ton trucks.
- (e) One Ford 4-ton platform with Pittman hoist.
- (f) One portable 20 HP high pressure boiler on wheels.

Other equipment from the local municipalities is available and usually required and includes several loaders, 3 D7 dozers, 1 D5, 2 crawler backhoes, boom truck.

2. RESUPPLY EQUIPMENT

The NTCL operation during the short resupply season is based on maximizing the available equipment. Although only one tug is used on the service, there is duplication in barges and handling equipment to enable one set of barges to be loaded while the other set is delivering cargo to the receiving ports.

Since the operation of cargo and handling equipment, loading and securing takes considerable time, the duplication of barges and handling equipment results in a turnaround time of only several hours, sufficient to fuel and provision the tug.

2.1 Marine Equipment

Tug: M.V. Keewatin, built in 1974, 3,375 bhp, speed 10 knots, length 37m, breadth 11.6m, molded draft 3.65m, running draft 2.0m, two towing lines.

Barges: 4 deck/bulk fuel barges, 2 with covered decks, length 64.0m, breadth 17.1m, molded depth 3.96m, load area 50m x 14.6m, light draft .25m, maximum load 1,876 tons.

2.2 Loading/Unloading Equipment

2	truck tractors
4	Highboy trailers
3	950 Cat 8 tonne forklifts
1	966 Cat 9 tonne forklift
1	910 Cat 4 tonne forklift
1	Hyster 5 ton forklift
7	Hyster various small forklifts

3. RESUPPLY OPERATIONS

Marine cargo destined for the resupply ports is generally one of four categories:

- . general cargo or pallets
- . cargo containerized or on trailers
- . heavy equipment and vehicles, and
- . bulk fuels,

all of which are handled by different methods.

Goods are received in Churchill by rail and are delivered either directly to the wharf facilities or to the town station, and then transferred indirectly through local merchants or directly by road to the wharf facilities. Bulk fuels are received by rail at the Esso tank farm terminal east of the grain elevator, and then transferred via pipeline to the main wharf.

Rail cars carrying general cargo are positioned inside the transit shed along its east wall. The portion of the shed that is leased to NTCL will accommodate up to five normal sized boxcars for simultaneous unloading.

The shed floor level is at the door level of the rail cars so that direct unloading is possible. The goods are then sorted and stored in consignments for each destination. Some repacking and palletizing takes place to prepare the cargos for marine transportation. A shrink wrap machine is also extensively used to protect vulnerable cargos in transit, and also to protect goods stored outside the transit shed prior to shipment.

Goods arriving by truck trailer are handled similarly; however, it is noted that, due to the lack of high level unloading dock for trailers, unloading is difficult.

Large items and cargos unaffected by weather are generally received, unloaded and stored outside, to the north of the transit shed. There is a low level rubble fill ramp adjacent to the rail line north of the transit shed which is used to assist in unloading. Particularly large or bulky items may be lifted by crane directly off the rail cars.

Storage space is at a premium during June and early July, and NTCL frequently stores cargo outside their leased area and transit shed. Cargos are required to be received at the Churchill terminal usually two to three weeks prior to shipping. In preparation for shipping the goods are collected and repalletized, tied and placed on or in truck trailers according to shipping requirements. A week prior to the scheduled departure, loading of the barge usually commences, slowly at first, then typically much faster as the departure date draws nearer. Because of the nature of the transportation system, exact schedules are not obtainable. Radio communication with the tug is frequent and updates are necessary to coordinate and time the loading operations. NTCL are very familiar with the consignees' locations and the off-loading constraints. Goods are shipped accordingly, large quantities are prepacked and pre-loaded into or on trailers, which are then rolled onto the barges. Small lots and vulnerable goods are placed inside the covered storage. Typically the covered barge would be jammed full from deck to ceiling. Finally, large items and other general cargos are loaded on board, along with the unloading and transportation equipment necessary to make deliveries.

During the cargo loading sequence, the barges lie on the east side of the wharf, parallel to the wharf, in the winter berth area, just to the north and east of the transit shed. The barges are generally loaded one at a time by using forklifts and by roll-on, as tides permit, as there is no ramping system to allow direct access to the barges at all times of the tidal cycle. A good portion of the time the barges are lying on bottom because of the shallow draft within the basin and the high tidal range. As one barge is fully loaded with general cargo, it is shifted to allow the remaining vessel to berth and take on cargo. All cargos are secured, then the barges are moved to the extreme north end of the wharf where they lie, parallel to the end and take on their load of bulk fuels from the underground pipeline header connected to the Esso tank farm. Here there is adequate draft to allow the barges to take on maximum loads. The Ports Canada small harbour tug is used to perform all the berthing maneuvers during loading and in preparation for departure.

The NTCL tug, the "Keewatin", after berthing the empty barges from the previous trip, refuels and takes on provisions in as little as two hours.

Prior to departure, the barges lie abreast of the north wharf wall. Two separate tow lines are attached to the barge pulling chains. The tug departs the berth with the barges in tow, side by side, and about 50 metres behind. Once outside the harbour, and into open water, the barges are separated and allowed to follow each other several hundred metres behind the tug. The tug and barges travel up the west Hudson Bay coast approximately 10k offshore to avoid shallow water that may foul the tow.

The empty barges that were temporarily berthed on the west side of the wharf are then shifted to the loading position adjacent to the transit shed, on the east side in the winter berth area. The on-board equipment is unloaded and used to reload the barges, and the process is repeated.

4. PROBLEM AREAS

- (i) The lack of a deck level ramp for loading and unloading truck trailers, particularly covered trailers, causes extra work and effort. The cargo must either be unloaded from the side by forklifts on the ground in the case of flatbeds, or the goods must be pushed and pulled on and off or handled manually with covered trailers.
- (ii) At the beginning of the shipping season, there is a definite shortage of space within the covered transit shed and on the north end of the wharf. The portion of the transit shed leased by NTCL is literally filled to the rafters and the wharf area is entirely filled with cargo and vehicles for a period at least until the first shipment. The area becomes quite congested and some inefficiencies due to double handling result. However, this is for a relatively short period and by mid August the area is quite empty. The NTCL lease comprises approximately two-thirds of the wharf north of the transit shed; however, they use most of the entire area for storage during peak periods.
- (iii) The barges are loaded on the rear or east face of the wharf in the winter basin area adjacent to the transit shed. Barges are loaded usually one at a time from the side or bow. The winter basin is very shallow and, due to the tidal range of some five metres, the barges are grounded twice daily during loading operations. Palletized goods are typically double-handled by a shore-based forklift on the dockside and a barge forklift which picks up and stows the cargo.

Heavy loads, containers and trailers that cannot be handled by forklifts must be loaded Ro-Ro during limited times, according to barge freeboard and tide levels. A loading ramp would greatly facilitate operations.

- (iv) The wharf surface is mainly gravel and fill material, with some paved areas, and is in some areas rough or uneven. This causes some minor inconvenience to the forklifts and may result in damage to some cargos. It also results in decreased usable storage space.
- (v) The traffic and lane patterns on the wharf north of the transit shed could be improved. Direct access to the barges from the shed is desirable. At the present time, forklifts must travel approximately 100 metres to get to the barges, whereas a direct route is only approximately 20 metres. Improvement in this routing was ongoing at the time of the site visit.

5. CONFLICTS

The resupply operations seem to operate very smoothly, with a minimum of conflict with other Port operations. The resupply vessels do not use any portion of the main wharf face for loading or unloading. Only when the tug and barges have returned from a trip do they moor on the main face for several hours until the tug and loaded barges depart. The empty barges are then moved to the loading berth behind the wharf. Short conflicts could arise if the entire main wharf were taken up by grain or other large vessels, in which case the barges might have to be moored or beached elsewhere until they could be placed for loading.

The marine equipment is well suited to utilize the designated berth facilities. The barges can be easily maneuvered or beached and do not encumber other terminal operations.

If vessels were to be used as an alternative in the resupply system, they may interfere or conflict with the ongoing grain operations. Typical alternate vessels are up to 114 metres long, with a beam of 16.8 metres and a draft up to 3.2 metres (reference vessel Federal Pioneer). A vessel this size, if berthed at the north face, would project approximately 25 metres beyond the west face of the wharf. This would interfere somewhat with vessels approaching and berthing at the north end of the main wharf.

Additional dredging of the channel along the north face of the wharf would allow the alternative resupply vessels to be berthed further to the east, which would eliminate the projection into the main channel or berths. However, this dredging might undermine the wharf structures.

Should other vessels with drafts greater than 6 metres be considered, they would require the deeper Dalgliesh Berth.

Larger vessels will find, however, that maneuvering in and out of the north slip may present some difficulties, even with tug assistance. This is due largely to the high tidal flows and also because of the narrowness of the channel. This may be of particular concern at the beginning of operations, until the crew is very familiar with marine conditions at the wharf.

If it proved unsatisfactory or unsafe to use the north face of the wharf for larger resupply vessels, then conflicts between the Ports Canada operation and the resupply vessel could occur. The resupply operations would then take up an entire berth along the face of the main wharf. This could conflict with the grain operations, especially during peak traffic periods.

6. DESIRABLE IMPROVEMENTS

Desirable improvements are those that would increase efficiency and simplify handling and shipping operations at present, and also if the service is to be expanded. The following improvements should be considered:

- (i) A truck ramp with floor level access from inside the transit shed is required. This is to ease and speed loading operations, particularly into covered trailers. This could be constructed by excavating a ramp down at the north end of the transit shed.
- (ii) The existing low level unloading ramp for rail flatcars should be restored and topped with asphalt or concrete to ease the transfer of heavy cargos. It also should be expanded to allow greater access to the rail cars.
- (iii) A large portion of the operating time is spent in preparation and sorting of the cargos, not directly in loading. Loading begins in earnest usually several days prior to shipping. Improvements could be made to increase the time available for loading by constructing a moveable ramp, which would allow constant direct access to at least one barge. Materials could then be transferred directly from warehouse or storage to the barge. It may also be possible to handle prepackaged or large lots of cargo directly from rail to barge and improve efficiencies immensely.
- (iv) Increased space is a definite requirement for any increase in cargos. It is desirable to have covered space as storing goods outside often requires that they be provided with some protection from the elements. This creates an extra step in handling. The NTCL operator now presently uses a shrink wrap machine to cover unprotected goods. An

extra 2,399 square metres would be available inside the transit shed if the Ports Canada equipment and spares were stored elsewhere.

- (v) Improvements should be made to the wharf surface in some areas and redundant utilities or rail lines removed to provide additional storage and improve operations. Although the quantities may be small, it may create the opportunity for better use of the available wharf space.

An evaluation of these alternatives is shown in Exhibit A-5.

7. POTENTIAL IMPROVEMENTS

Potential improvements are those major capital improvements that may improve operations and efficiency in the longer term. The NTCL operations are now only geared for the short term; their lease is renewed every five years. These improvements may otherwise improve working conditions and safety, decrease losses or damage, speed or simplify handling, and generally improve operations. Such improvements are described in the following paragraphs:

- (i) In addition to levelling and removing redundant services, the entire wharf surface could be paved. This would increase accessibility to cargoes, improve travelling conditions on the wharf, create less wear on handling equipment, improve wet weather and spring thaw operations, decrease dust and keep equipment and cargo cleaner, and potentially allow bulk cargoes to be easily stored on the wharf without contamination.
- (ii) Install a sheet pile or crib wall on the east face of the wharf at the north end, opposite the old marine railway. The existing face is a gravel embankment, approximately 110 metres long and it cuts into the wharf surface area up to 5 metres wide. This is reclaimable land, approximately 550 square metres, which would be available for extra storage and could also form an additional berth for the resupply barges.
- (iii) Other improvements might be made in acquiring specialized cargo handling equipment. These could include container handling cranes, specialized forklifts and dockside cranes, among others, all of which do not seem to be required at the present time.

8. EXPANSION

During the short resupply season from mid July to mid-October, an average of about 18,300 tons of cargo are shipped via the NTCL operations. Most of these goods are received at the Port by rail very early in the season for early transport to the resupply ports.

EXHIBIT A-5

RESUPPLY OPERATION IMPROVEMENTS
(MTCL)

IMPROVEMENTS	REQUIREMENT	BENEFITS	DESCRIPTION	MAINTENANCE	CAPITAL COST
(1) Transit shed truck ramp	Necessary	Speeds unloading and loading of trailers	Install floor level truck ramp accessed to the transit shed floor	Minimal	\$5,000
(2) Low level rail unloading ramp	Necessary	Eases unloading of large items from flat bed rail cars	Improve existing ramp	Minimal	\$5,000
(3) Adjustable barge loading ramp	Necessary	Speeds barge loading operation Reduces double handling of cargo's	Install a Hydraulically or Mechanically controlled loading ramp to access at least one barge at all tide levels.	Low to Moderate	\$50,000/unit
(4) Inside storage space	Necessary	Reduces double handling and handling time Better protection for vulnerable goods, reduces need for shrink wrap step	Occupy the entire transit shed by relocating Forts Canada equipment elsewhere	Low	\$700,000 for new warehouse unless alternative is available
(5) Improved wharf surface	Necessary	Increases useable wharf area Speeds travelling time Reduces damage to cargo	Removal redundant items and grade of site, installing direct access laneways	Minimal	\$20,000
(6) Wharf paving	Optional	Speeds handling operation Decreases wear on machinery Cleaner cargoes improved runoff	Asphalt pave surface of wharf	Minimal	\$750,000
(7) Wharf wall on the North east face of wharf	Optional	Increase storage area Improve water access to winter berths	Install a steel sheet pile wall or alternatively install timber cribs similar to existing structure	Minimal	\$640,000
(8) Specialized Handling Equipment	Optional	Increase loading rates Eases loading operation	Supply specialized cranes, gantries, carriers, forklifts etc., depending on types of cargo's (container, bulk)	High	\$50,000+

Cutoff dates for receiving cargo at the Port are about two weeks prior to shipping and it is usually advantageous for the customer to have most of his cargo at the Port early in the summer. Thus, the transit shed is "jammed to the rafters" and the wharf is full early in the season, until some of the larger shipments have been removed. During July and early August, cargos take up most of the wharf area north of the transit shed, including the wharf area outside the NTCL lease.

There are several options for expansion within the existing Port facilities, depending on the scale of operations expected. Marginal increased storage space could be acquired by utilizing the entire transit shed and relocating the Ports Canada equipment and stored goods elsewhere, either in a new shed on the wharf or in existing storage buildings closer to the elevators. This would increase storage capacity indoors and reduce additional handling and packaging that would be required to store and protect (shrink wrap) the goods if they were outside.

An indirect method of increasing the effective capacity of the existing facilities would be to pre-consolidate shipments. Ideally, the goods and cargo would arrive in Churchill in consigned lots for shipment to the individual resupply ports. These consignments would arrive just prior to the required delivery dates and would be prepacked and sorted so that little handling or sorting would be required at the Port. The goods would then be unloaded, stored for a short period, and then transferred to the barges for shipment. This would, however, require a consolidation terminal elsewhere in the system. Winnipeg would be an obvious choice; however, a new facility and warehouse in the town of Churchill might also serve as well.

Expansion of the Churchill Port facilities would increase the capacity of the resupply operation dramatically. Several options are available. Because of the relatively shallow draft requirements of NTCL vessels, new facilities would not be nearly as expensive as creating new facilities for deep draft vessels. Dredging and wharf material costs would be substantially reduced.

Based on the physical layout of the harbour facilities, the influence of the river and ice conditions, and the general site hydrography and topography, three potential areas for Port expansion have been identified: north of the existing wharf, behind the existing facilities, and a southerly extension of the present grain wharf. These development areas have been classified north, central and south, and are evaluated in the following sections.

The evaluation of the resupply expansion options is summarized in Exhibit A-6.

EXHIBIT A-6

RESUPPLY EXPANSION
EVALUATION OF ALTERNATIVES

ALTERNATIVE	FACILITIES			OPERATIONS			MAINTEN- ANCE	CAPITAL COST	CONSTRAINTS
	Area Ha.	Berth Length	Berth Depth	Rail Access	Road Access	Navigation Access			
North	5.2	290m	3.1	good	good	good	nominal	\$9.9 M	- Potential land use problem - May interfere with grain operation - Relocation of winter berth
Central	4.3	200m	3.1	limited	limited	limited	nominal	\$7.7 M	
South	6.6+	300m	3.1	good	good	good	nominal	\$10.4 M	

8.1 Area North of Wharf

Description

Immediately north of the wharf is a small bay bounded on the north by the steep, rocky outcrop forming the Cape Merry Peninsula; on the east by a gently sloping sandy beach, and on the south by the dredged channel to the winter berth area. This channel around the north end of the existing wharf is 74 metres wide, with a depth of 3 metres, except where it has been deepened against the wharf to 6 metres. This area consists mainly of tidal flats rising up a sandy beach towards shore. The area available for reclamation (see Exhibit A-7) is about 5.2 hectares and would extend from the winter berth channel about 310 metres northward along the harbour headline towards Cape Merry Peninsula. Additional storage area could be created by cutting into the low rocky backshore area east of the existing rail line. The topography of the site ranges from 0 to 7 metres above LWOST.

The development of this area may cause some concerns as part of the area is thought to be historically significant and belongs to Parks Canada.

The foreshore area is presently used as a landing for various small craft, such as tour boats, pleasure craft, etc. In addition, an analysis of a small craft docking facility for the Churchill Community Development Corporation by Anderson Management Services Inc., in February, 1984, selected this area as one of two feasible sites for a marina.

Reasons for Site Selection

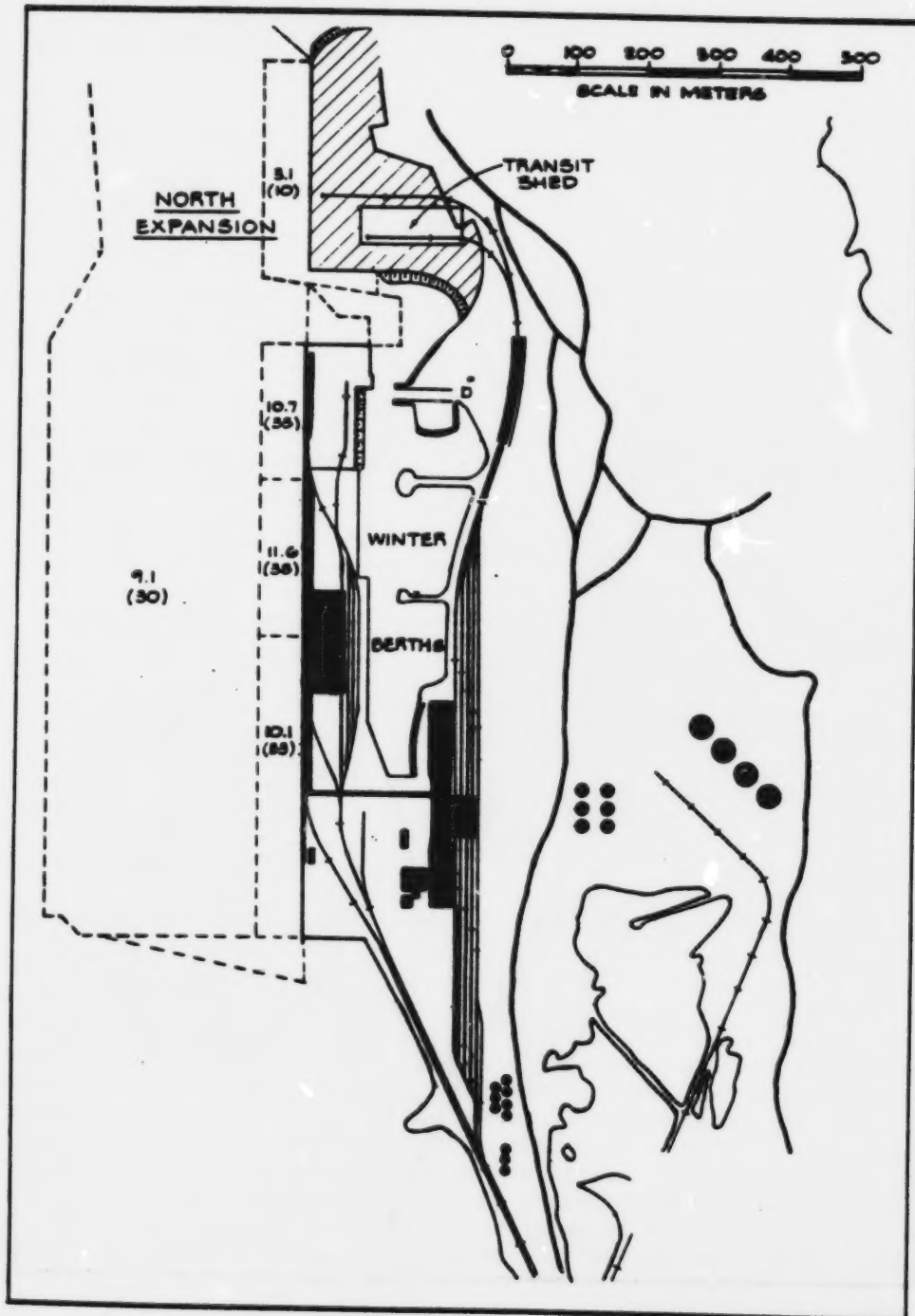
This area north of the existing wharf has the advantage that a large storage area is available, which could be expanded, as required, to the east of the railway track. It provides a natural extension to the present facility. It is easily accessible by rail and road. It would have to be separated from the main wharf to maintain access to the winter berthing area; however, the slip that would be formed would provide additional berthing space.

8.2 Area Central to Wharf

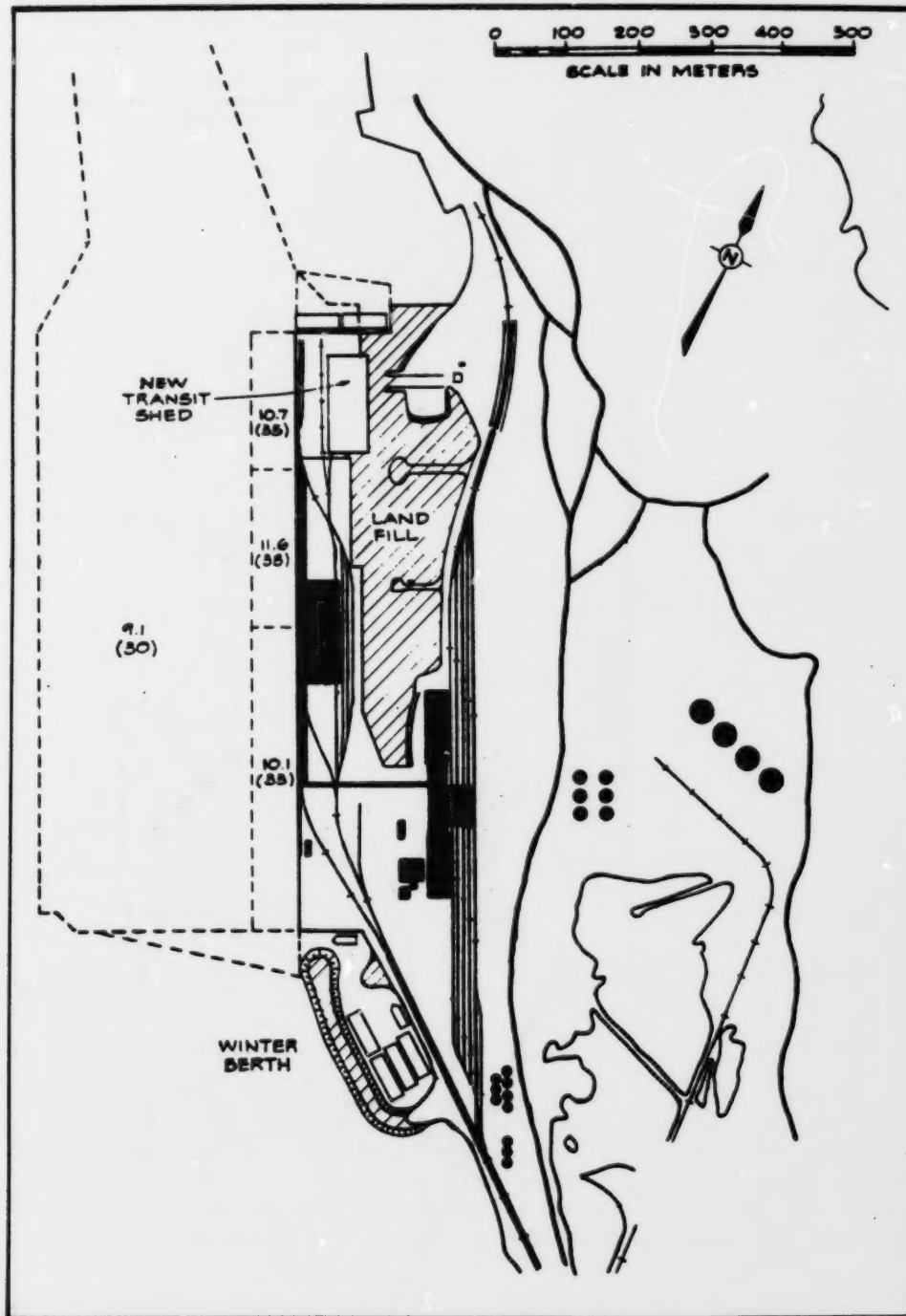
Description

The water area immediately behind the existing wharf facility, which is presently utilized for winter berthing, presents an interesting opportunity for reclamation for additional storage (see Exhibit A-8). The area of about 100 by 600 metres would provide an additional 4.3 hectares of storage and would require only a short span of sheet pile wall at its northern opening to form a berthing face for the barges.

PORT OF CHURCHILL NORTH EXPANSION CONCEPT



PORT OF CHURCHILL CENTRAL EXPANSION CONCEPT



Reasons for Site Selection

The immediate need for expansion of the resupply operation is additional storage space. This area can be easily attained by backfilling behind the existing wharf. Such a development would require relocating the winter berths.

Exhibit A-8 indicates an alternative location of the winter berths at the southern end of the main wharf.

8.3 Area South of Wharf

Description

Immediately south of the wharf is an area of tidal flats, increasing in width from about 60 metres at the south end of the wharf to approximately 500 metres upstream of the wharf (see Exhibit A-9). This area roughly corresponds to the area bounded by the 0 metre sounding which is in line with the present harbour headline on the west and the rail line, or the high water line on the east. These tidal flats extend upstream an unlimited distance but, for practical reasons, the area is limited to about 6km.

This area is relatively flat and would require extensive dredging to allow marine access.

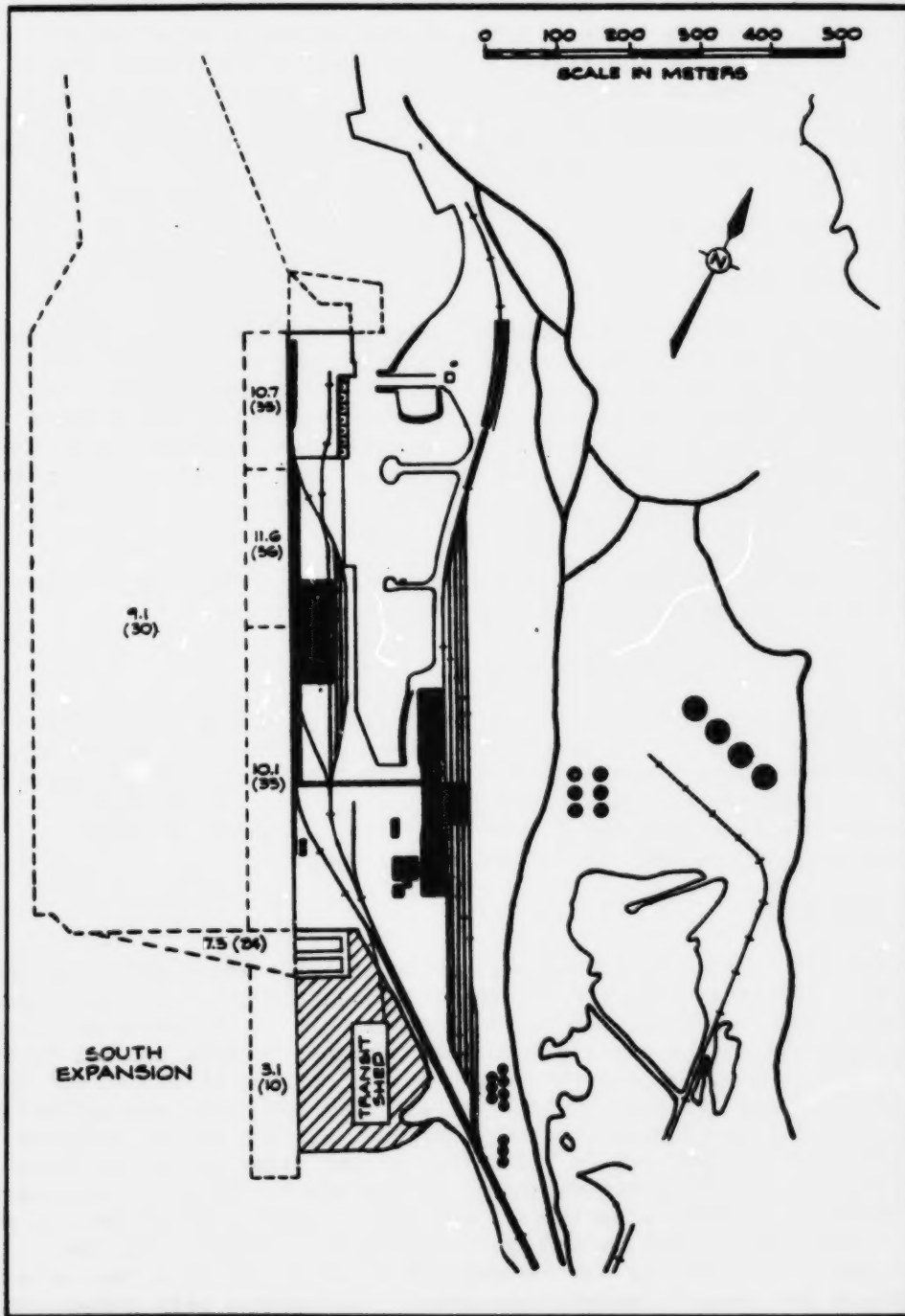
Reasons for Site Selection

The area south of the wharf has the advantage of having unlimited land areas available for reclamation. It would be possible for it to be connected directly with the existing facility and would not interfere at all with any of the ongoing port operations. It is readily accessible from town and to the rail line, and forms a natural extension to the Port facilities to the south.

9. WINTER BERTH

Churchill harbour is frozen over solid at least seven months of the year. The effects of the ice conditions at Churchill are very severe due to the high tides and swift currents. It is necessary to store or harbour all marine vessels such that they will not be subject to ice damage. Storage on dry land would be the optimum solution, but the capital costs for removing the vessels from the water are extremely high. At present only the small harbour tug, the George Kydd, is stored in the dry. It is lifted out of the water using the Ports Canada 90-ton crane and is stored on the wharf. Prior to the wharf expansion in 1963, a marine railway was located north of the old wharf and was used to haul up and store the harbour vessels over the winter. Its capacity was limited and it would not have been able to handle the present resupply equipment. It has now been dismantled, although the cribwork remains.

PORT OF CHURCHILL SOUTH EXPANSION CONCEPT



The next best solution would be to store the vessels in an isolated basin, preferably pumped dry or with a constant water depth.

The existing winter berthing arrangement provides that the inner basin behind the wharf is closed off from the daily tidal variations and the water within the basin stabilizes and freezes at about mean sea level.

NTCL operations generally end in early October, following which the tug and barges are moored into the winter basin, the inner basin closed, and the operation ceases for the year.

The inner basin was completed in 1978 and put into service that year. It was initially intended to pump and keep the basin dry but this proved unsuccessful. The basin was constructed with a concrete berthing pad on which one of the barges could rest. This was in order to facilitate the required hull inspections. Repair work and inspections are generally done in the spring.

Work in the spring usually begins in early May with the cleaning of ice from around the vessels and the berthing pad to allow the vessels to be moved around for hull work, inspections, etc. This work is usually done using a backhoe and a front end loader. There may be up to 1.3 metres of ice present.

The berm-dike is opened in late June or early July, depending on conditions, and the barges are loaded. The first trip takes place from the second to third week of July to the Eskimo Point settlement.

APPENDIX B

KEEWATIN RESUPPLY PORTS

APPENDIX B

KEEWATIN RESUPPLY PORTS

1. OVERVIEW OF OPERATIONS

Prior to the opening of the resupply season, the operators make an inspection of the harbour and wharf facilities within each of the resupply ports. The inspection team generally includes the Master of the tug Keewatin, the NTCL General Manager and a representative of the NWT and Canadian Governments. The operators make requests and suggestions required to upgrade or reinstate the facilities for receiving the tugs and barges. Generally the NWT Government will issue a work order to the local authority to make the necessary improvements. These improvements generally entail removal of ice transported rocks and debris from the landing area and replacement of gravel and sand materials that have been washed away or lost during the winter.

The resupply season starts in July, usually during the second or third week. The first shipment is to the settlement of Eskimo Point, 289 kilometres north of Churchill, on the west coast of Hudson Bay. The actual date of sailing is carefully chosen, dependent on ice conditions and forecasts up the coast. The tug and barges require at least 20km of clear water between the shore and the main ice pack in Hudson Bay. This considerable distance is to allow free passage of the vessels at least 16km offshore, which clears most of the shoals and shallows that interfere with the towing lines. The remaining four kilometres allow for vessel navigation and shifting ice.

It is usually conditions at or near the resupply settlement that govern early barge service. By mid August, however, all of the ports are clear of ice and the bay ice is no longer of concern.

At most of the resupply harbours, prior to entering and berthing or mooring in the shallower waters, a small motor boat from the Keewatin is used to mark the appropriate channel for safe and efficient entry and berthing in the harbour. These markers are left in for the season but are carried off by the ice during the winter. In general, the fuel or a portion of the fuel cargo is pumped off first. This is done by mooring the barge close to the pipeline header, then connecting and pumping off through the barge's floating pipeline. Motor boats are used to handle the floating pipeline.

The barges are then berthed, actually grounded on the beaches at high tide at the landing sites. These sites usually consist of earth pushouts forming a pier and the barge is berthed bow to and held in

place by shore anchors. The dry cargo unloading operation begins while the second barge is positioned and fuel cargo is pumped off via floating pipeline.

2. RESUPPLY PORT DATA

2.1 Eskimo Point

Eskimo Point is located at 61 degrees 07'N, 94 degrees 04'W, and is 156 nautical miles (289km) north of Churchill on the west coast of Hudson Bay (see Exhibits B-1 and B-2). It is about 18km south of the Maguse River, on a narrow, sandy peninsular beach ridge, with muskeg covered marshes to the south and characteristic tundra vegetation.

Eskimo Point has a mean tidal range of 2.7 metres and a large tidal range of 4.4 metres. The tidal currents reach rates of two knots on the ebb and up to five knots on the flood tide near the reefs off Sentry Island. The settlement has a radio beacon to assist navigation.

The return trip for NTCL takes an average of five days from Churchill.

Navigation approaches are very difficult. The areas to the north and east of Eskimo Point are filled with reefs. Depths as little as 2.9 metres lie to the east of the harbour and rocks at the 3.4 metre depth lie 3.9km east of Eskimo Point. Although a channel with a depth of 4 metres or more runs in between these rocks and flats, it shoals to 2.9 metres, 800 metres from the hamlet, and to 0.9 metres or less close to the hamlet. The NTCL operators use a motor boat from the tug Keewatin to mark the channel with buoys before bringing the barges in to the landing beaches.

The barge landing site is an old gravel-filled barge, located at the end of a 32 metre long gravel pushout. The NTCL barge lies bow to the end of the gravel-filled barge-wharf and is secured by two shore anchors on either side of the pushout. The wharf is located in the centre of town, opposite all of the main commercial and administrative facilities (see Exhibit B-2).

Fuel is also unloaded here through a pipeline located on shore, immediately to the east of the pushout. The town fuel storage tanks are located approximately 150 metres due south of the landing site. A pipeline runs south from the tanks to the airport 1.6 km south of the hamlet.

exhibit B-1

ESKIMO POINT

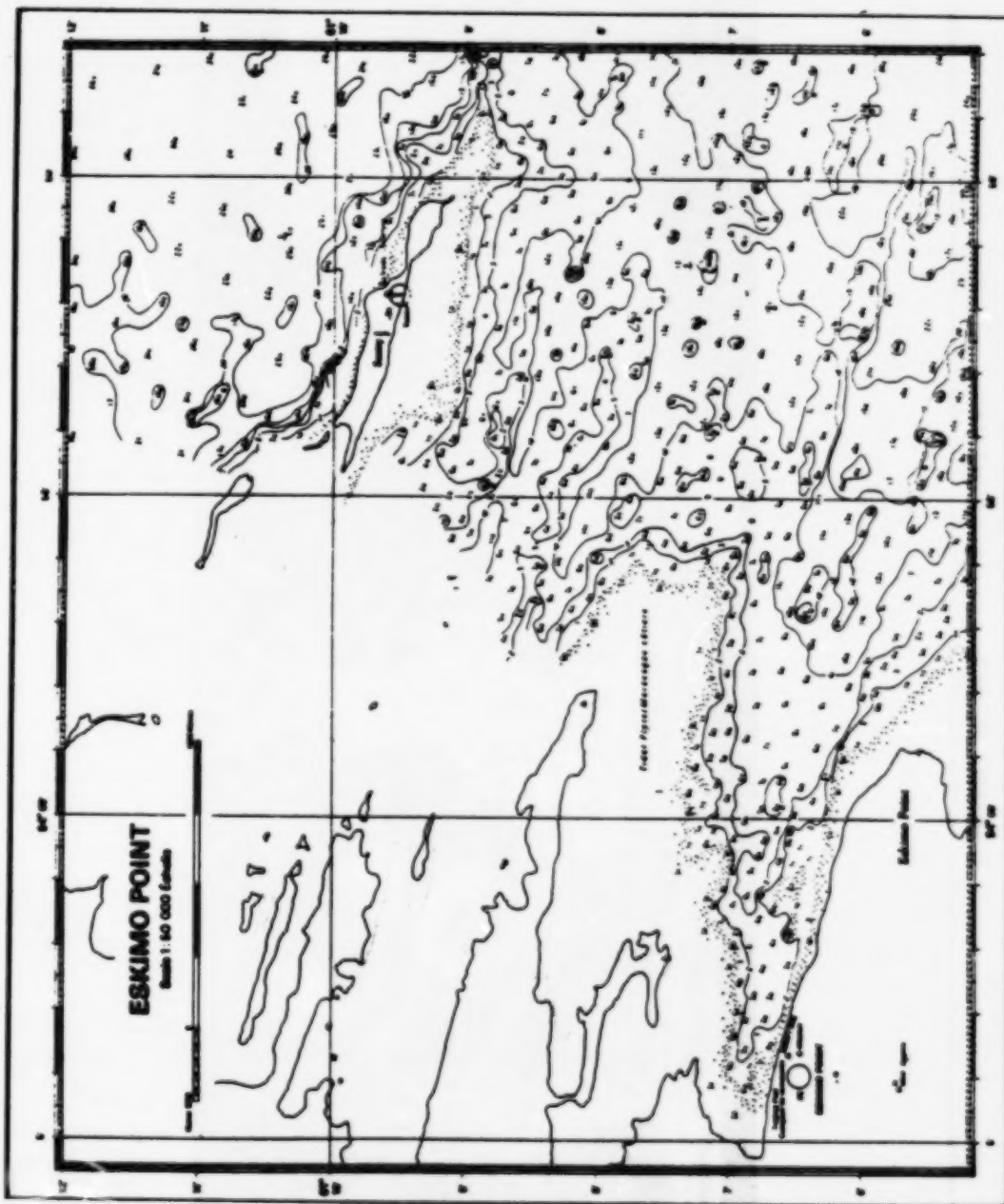
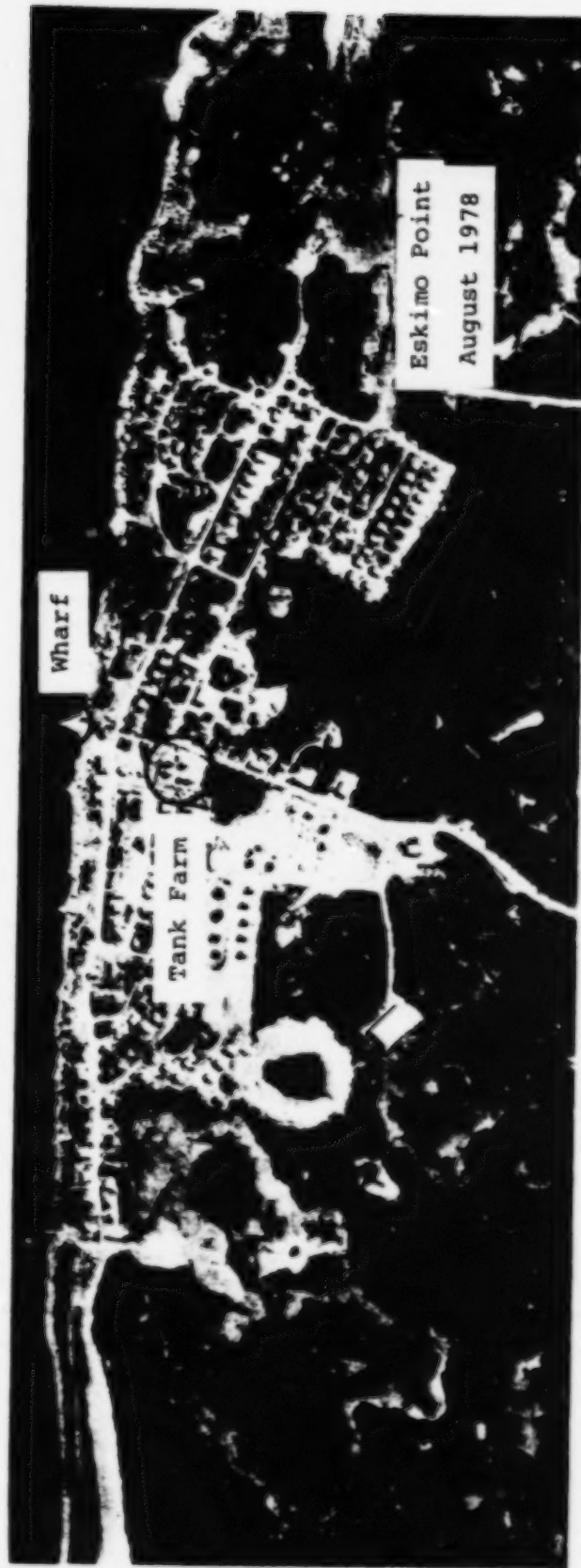


exhibit B-2

ESKIMO POINT AERIAL PHOTO



There is a small area adjoining the wharf for temporary cargo storage.

It would be possible to land and unload the barges anywhere along this relatively even beach, within the limits of the town and eastward towards the tip of Eskimo Point. In 1984 and several years prior, an old coastal freighter, the "Melita", was tied up alongside the present unloading wharf. This caused problems to the unloading procedure, so operations were successfully shifted to the beach area. The vessel has since been moved so operations have returned to normal on the pushout wharf, as described.

2.2 Whale Cove

Whale Cove is located at 62 degrees 10'N and 92 degrees 10'W on a peninsula at the head of Whale Cove in Wilson Bay (see Exhibits B-3 and B-4). Whale Cove is south-facing and sheltered with large sandy, gravelly areas, with rocky outcrops and typical tundra vegetation among low hills and a rocky coast. It is 220 nautical miles (408km) north of Churchill. Approaches are from the southeast, north of Walrus Island and Morso Islands. There are several reefs in the approaches, all of which are charted. Whale Cove itself has a deep channel up to within 200 metres of the shore, then it shallows rapidly. The cove is well sheltered on three sides but is open to storms from the south to the south-southeast.

The harbour has a large tidal range of about 4.4 metres and a mean range of 2.7 metres. An aeronautical radio beacon and a radar transponder are located near the settlement to assist navigation.

A round trip journey to Whale Cove takes an average of about five days for the NTCL barges and tug from Churchill.

Resupply barges approach and moor within the cove and unload fuel via floating pipeline to a header on the west shore of the cove, approximately 400 metres south of town. Storage capacity is 1,327,000 litres of P-50 fuel and 851,000 litres of gas as of December, 1983.

The barge landing consists of a dirt and gravel pushout, located approximately 400 metres east of the centre of town. The barge berths bow to and is secured with two shore anchors on either side of the ramp. As there is only a very small storage area adjacent to the wharf, goods are generally unloaded and transported directly to the consignee.

Annual maintenance consists of clearing ice-carried rocks and boulders from the landing area.

exhibit B-3

WHALE COVE

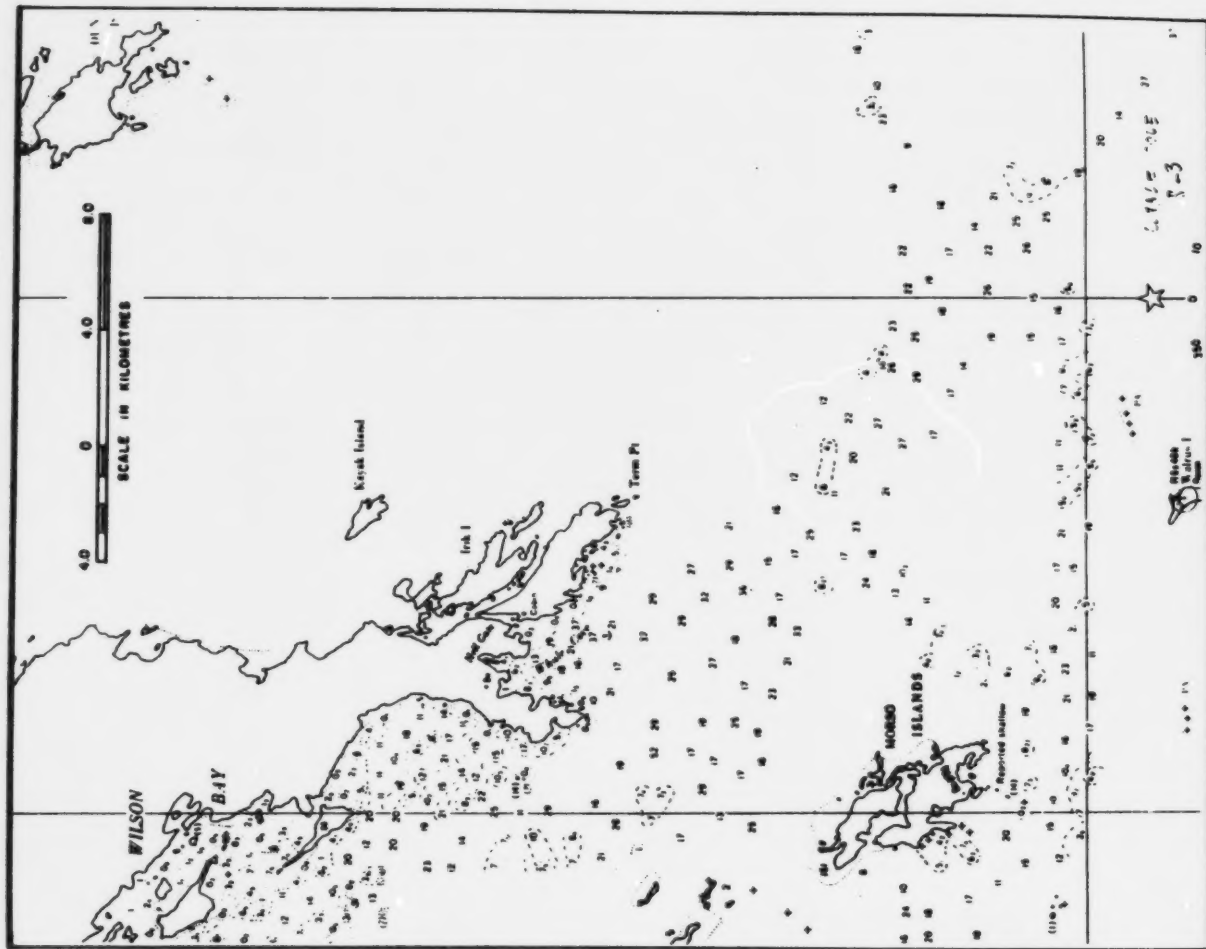
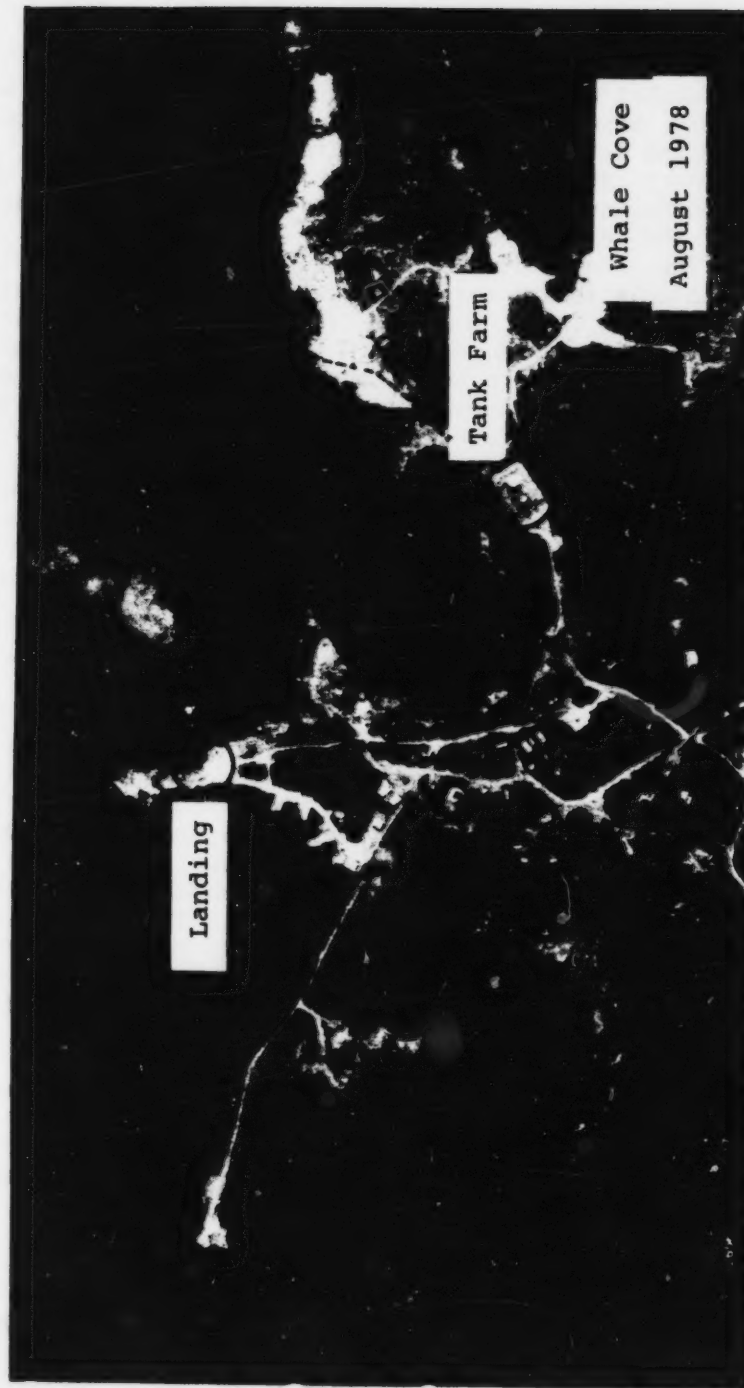


exhibit B-4

WHALE COVE AERIAL PHOTO



2.3 Rankin Inlet

Rankin Inlet is located 62 degrees 49'N, 92 degrees 05'W, on the west coast of Hudson Bay, between Whale Cove and Chesterfield Inlet (see Exhibits B-5, B-6 and B-7). This location is on the Kudlulik peninsula on the north shore of Rankin Inlet, close to its head. The settlement is situated on the southwest shore of Prairie Bay, which is a north branch of the inlet. Approaches into the inlet are from the west-southwest. The recommended track is south of Marble Island to an area between the middle shoals and separation shoals 15km southwest of the settlement of Rankin Inlet, then the track proceeds into Prairie Bay and changes direction six more times. The resupply tug and barges follow a narrower, more northern track to avoid some shoals that may interfere with towing lines. A pilot is strongly recommended by the Sailing Directions. The anchorage is 5km east of the settlement.

Rankin Inlet has a large tidal range of 4.7 metres and a mean range of 2.9 metres. Strong cross-currents have been noted at the entrance to the Inlet at about one knot on the flood tide and sometimes in the opposite direction on the ebb. A radio beacon is located near the settlement to assist in navigation.

It takes about seven days for a round trip from Churchill for the operator.

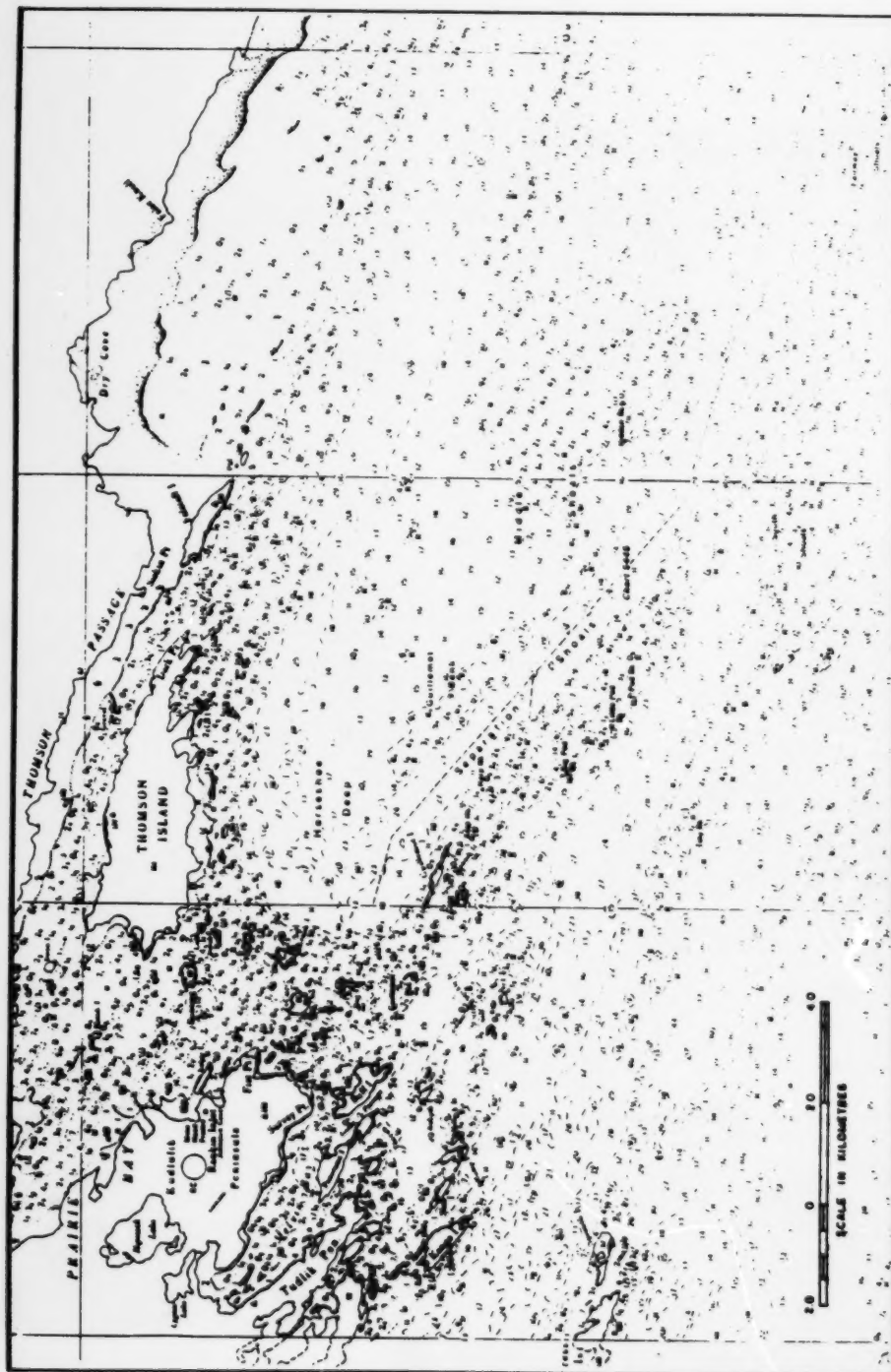
The harbour is an enclosed cove, known as Johnson Cove, and is formed by Kudlulik Peninsula on the south and west, Esker Island sandbar on the north, and by an unnamed island at high tide, or peninsula at low tide, on the west. A natural breakwater extension, approximately 50 metres long, off of the west end of this island, partially closes the entrance to the harbour. The harbour entrance channel is about 30 metres wide and is well protected. The fuel unloading wharf is on the south shore of the Cove and feeds two sets of tanks 100 metres inland on the edge of town to the southwest. The main cargo wharf consists of a 61 metre long by 9 metre wide gravel approach and a pierhead with a 23.7 metre landing face, 24 metres wide, comprised of three rock-filled former Transport Canada landing barges. Water depth alongside is less than one metre. Mooring consists of two deadman anchors on either side of the approach and one stern shore anchor to the adjoining beach, which runs parallel to the approach. There is a large storage area adjacent to the wharf available to store cargos for delivery.

2.5 Chesterfield Inlet

Chesterfield Inlet is located 63 degrees 20'N, 90 degrees 42'W, on a small bay about 1.5km wide and 1.0km deep, known as Chesterfield Anchorage on the south shore of Chesterfield Inlet (see Exhibits B-8,

exhibit B-5

RANKIN INLET



RANKIN INLET HARBOUR

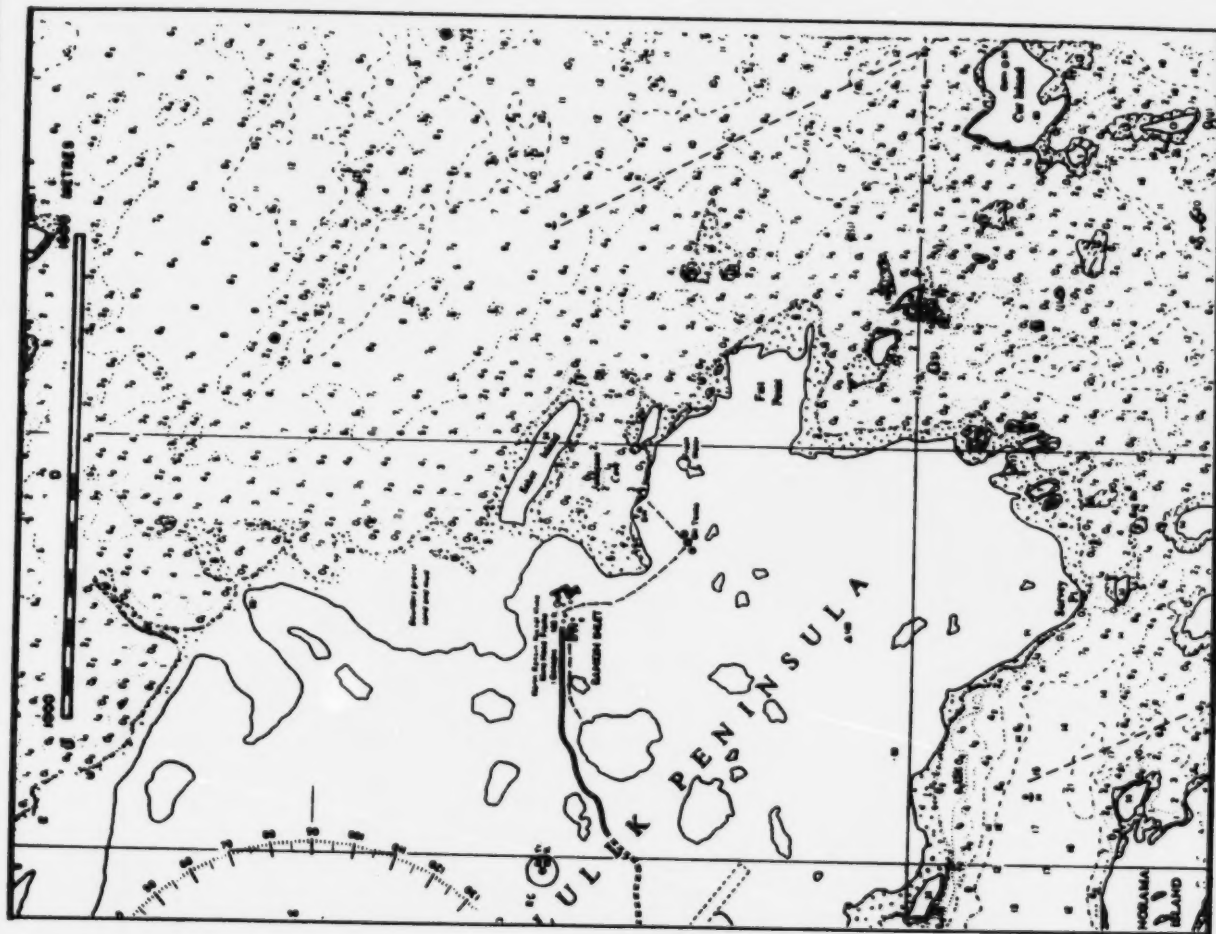
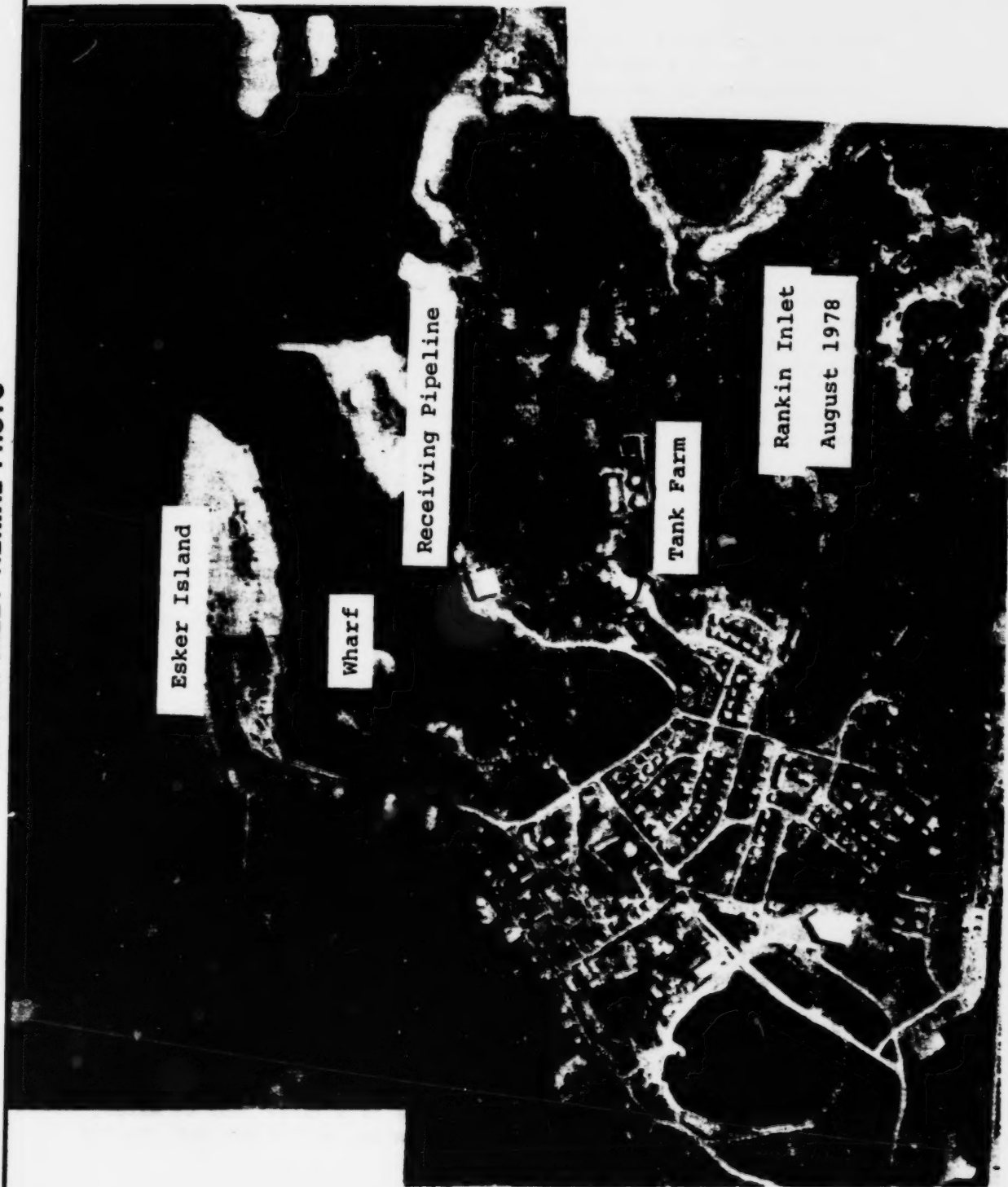


exhibit B-7

RANKIN INLET AERIAL PHOTO



B-9, B-10 and B-11). It is situated 302 nautical miles (562km) north of Churchill, on a narrow coastal strip composed of sand and gravel and surrounded by low granite outcrops and inland lakes.

Navigation into the Chesterfield Inlet anchorage is very open and easy from the east to southeast quadrant, south of Promise Island and Finger Point, and north of Fairway, Sakpik, Foxtrap and Clay Islands. Within the anchorage, water depth decreases rapidly about 400 metres from shore, from about 9 metres to 2 metres in a 100 metre length, after which it gradually decreases and forms a gently sloping beach.

The harbour has a mean tidal range of 2.9 metres and a large tidal range of 4.2 metres. Tide rips occur off Finger Point during large tides. A marine/air radio beacon near the settlement assists navigation.

It takes about seven days for a round trip for the NTCL tug and barges from Churchill.

The resupply operation is similar to that followed at the other ports. The tug and barges anchor offshore and fuel is discharged by floating pipeline to the NCPC power plant on the west coast of the Chesterfield Inlet anchorage, 500 metres from town. To unload the remaining cargos, the barges are beached, on the high tide, at a landing site consisting of a gently sloping, sandy beach, just east of the Hudson's Bay Company's warehouse and store on the east edge of the settlement.

Two shore anchors are used to secure the barge. Fuel is also pumped to the POL tank farm located on the rock outcrop, just east of the landing site. Capacity in use to December 31, 1983, was 1,750,000 litres of P-50 fuel and 368,000 litres of gas. The landing site requires little annual maintenance. Normally all that is required is to clear ice-carried boulders from the beach.

There is a limited amount of storage space adjacent to the beach, sufficient to marshal several trailers and some dry cargo before distribution to the consignees.

The harbour is exposed to the southeast and it is advisable to seek shelter elsewhere in Chesterfield Inlet in strong winds.

2.5 Baker Lake

The settlement is located at 64 degrees 18'N, 96 degrees 03'W, at the northwest end of Baker Lake, north of the mouth of the Thelan River (see Exhibit B-12 and B-13). Baker Lake is a large body of water, 70km long, roughly east-west, by 2.9km wide, with a maximum charted depth of 46 fathoms (84m).

CHESTERFIELD INLET

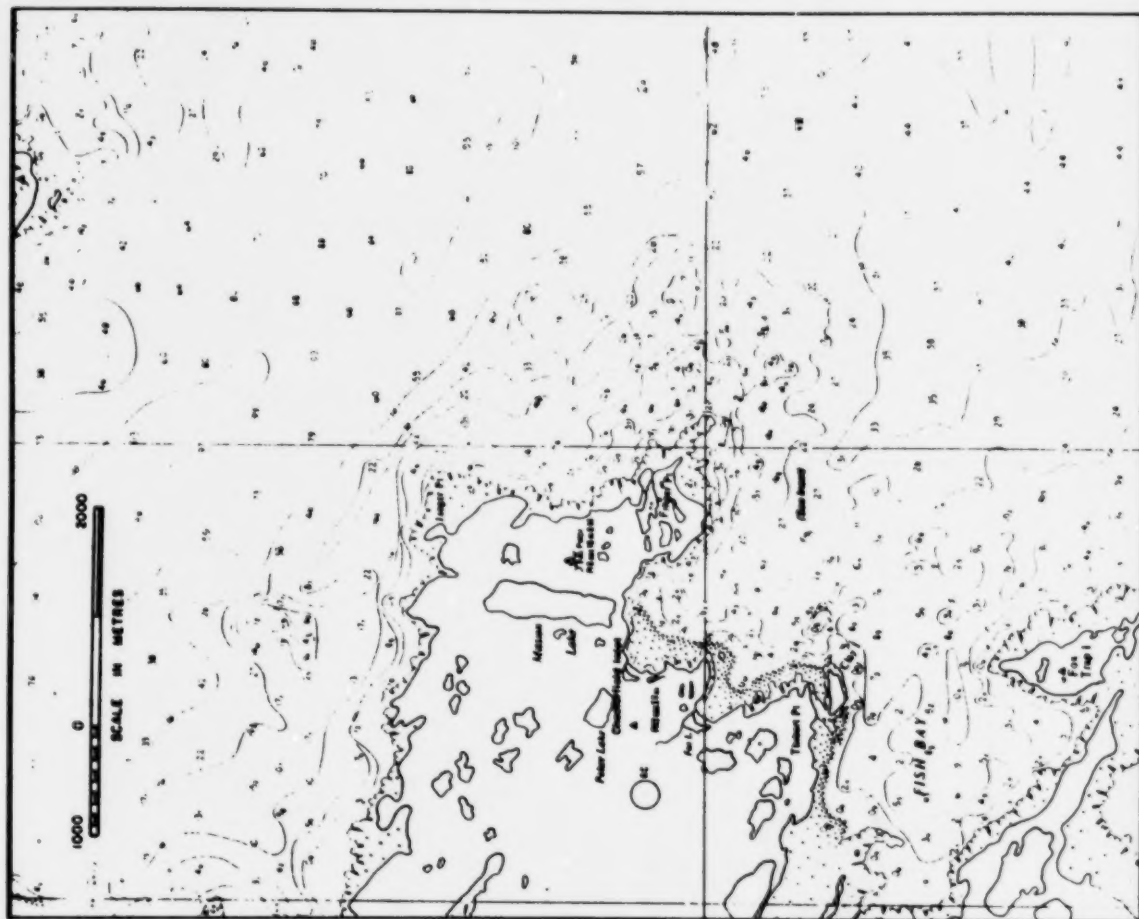


exhibit B-9

CHESTERFIELD ANCHORAGE

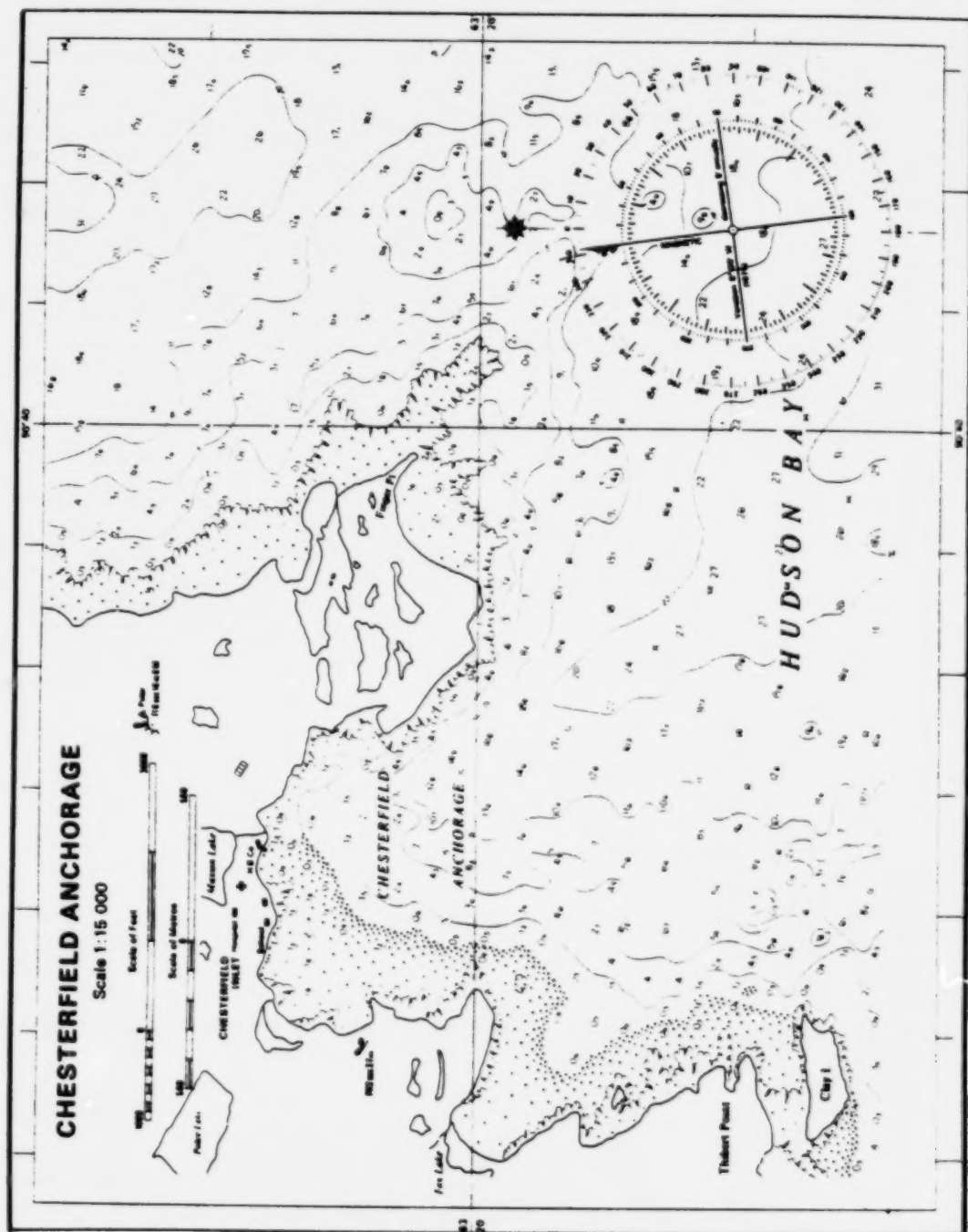


exhibit B-10

CHESTERFIELD INLET AERIAL PHOTO

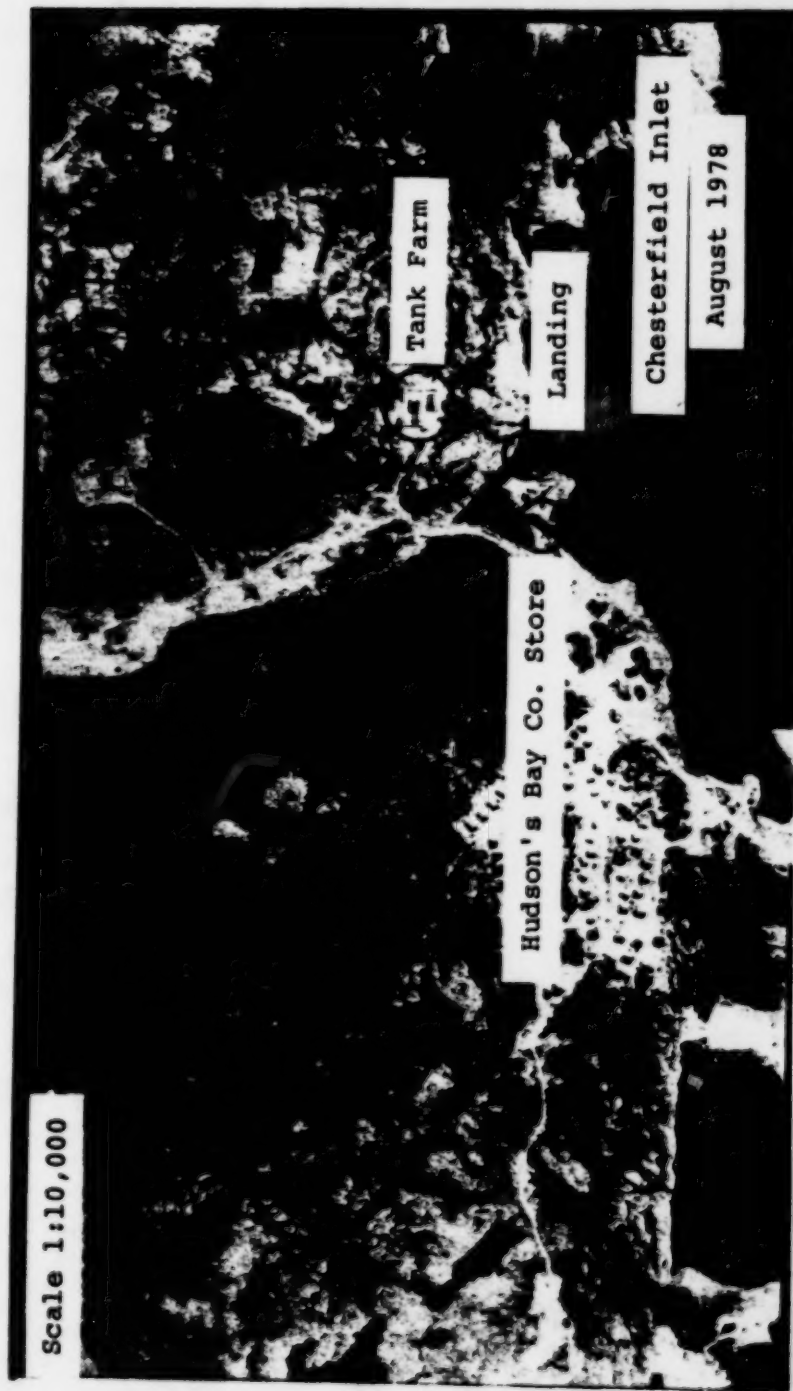


exhibit B-11

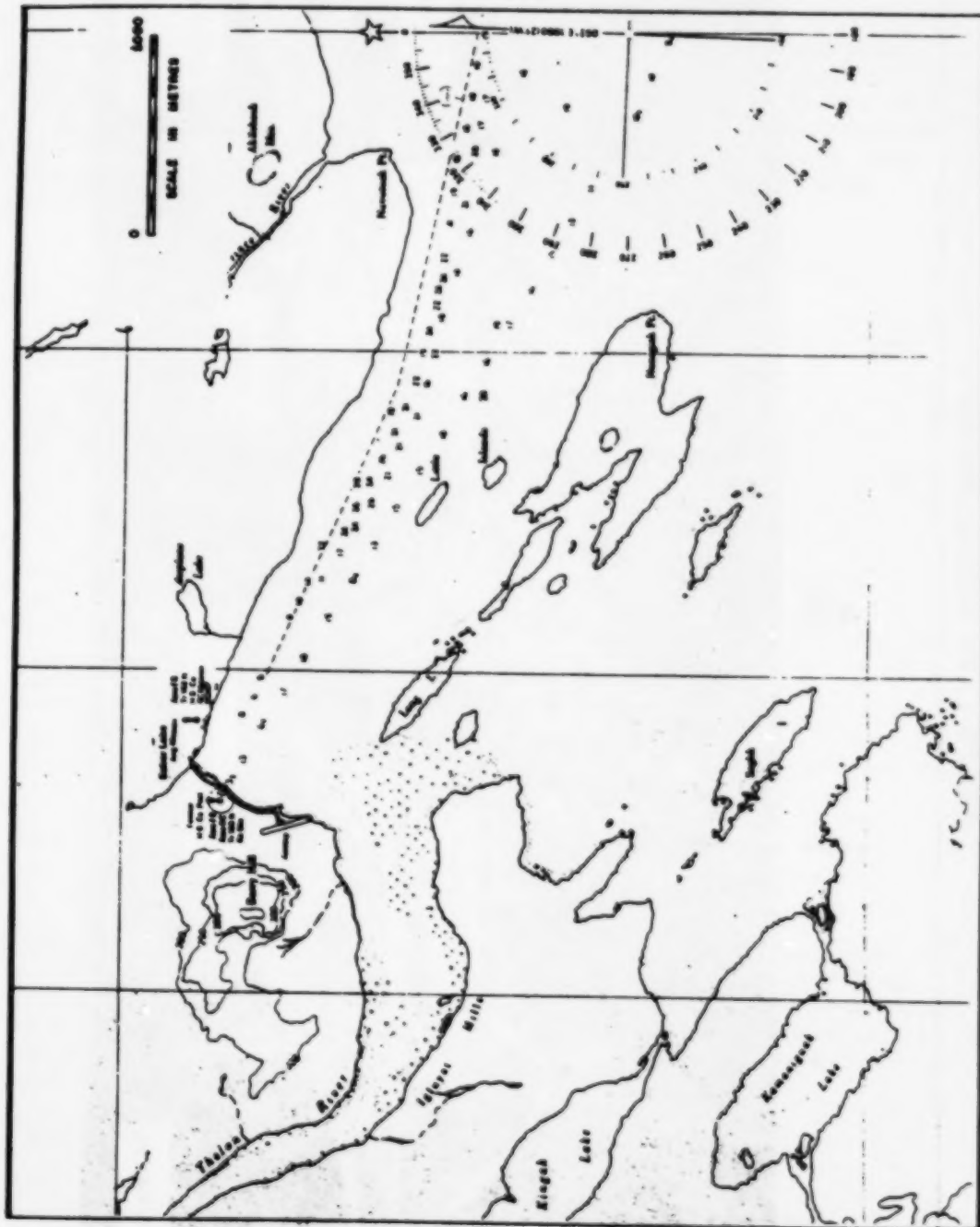
CHESTERFIELD INLET PHOTO



CHESTERFIELD INLET SETTLEMENT AGGLOMERATION

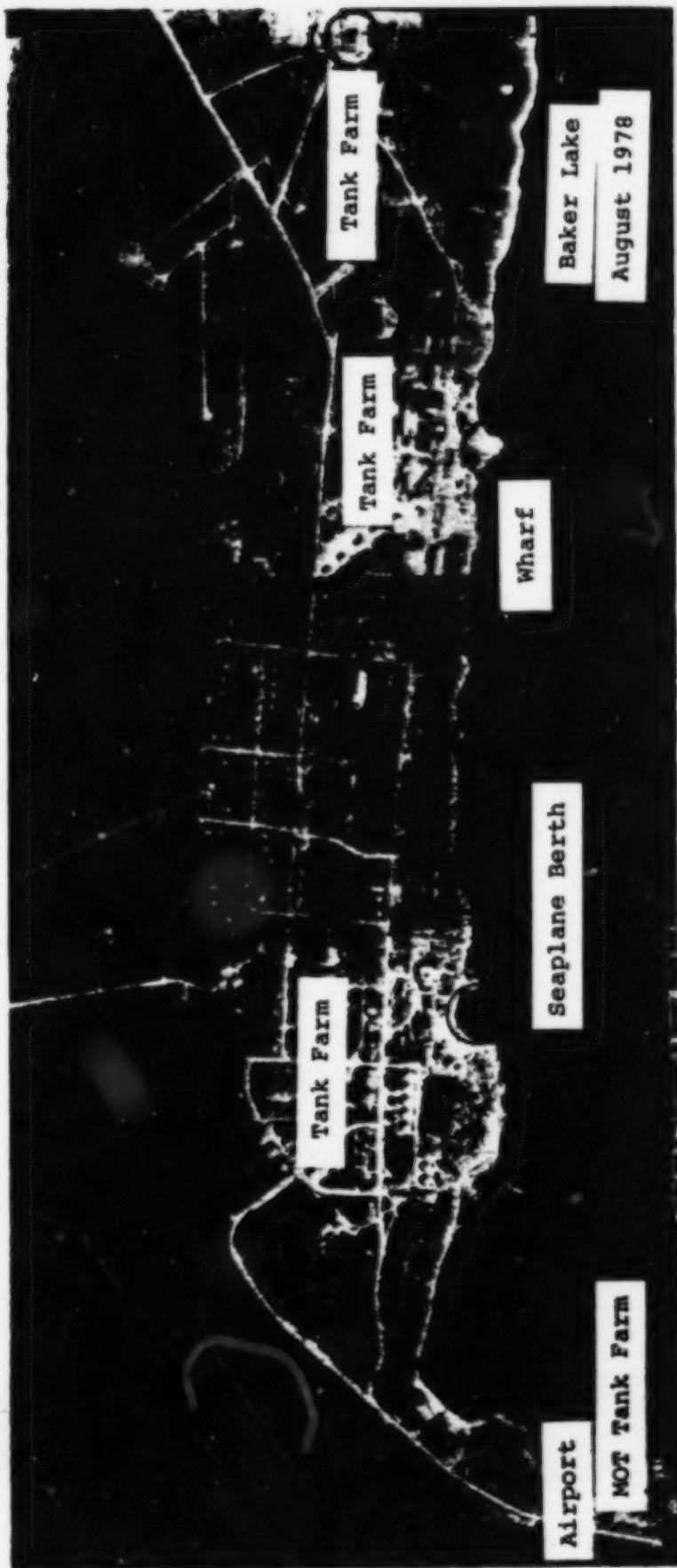
Photo from Canadian Hydrographic Service Sailing Directions

1



BAKER LAKE AERIAL PHOTO

A



Airport

NOT Tank Farm

Seaplane Berth

Wharf

Tank Farm

Tank Farm

Tank Farm

Baker Lake

August 1978

Baker Lake is located at the head of Chesterfield Inlet, some 200km from Hudson Bay. Along the recommended route into Baker Lake from Hudson Bay, a depth of 16 fathoms (29m) can be maintained as far west as Cross Bay, and 11 fathoms (20m) from there to Chesterfield Narrows, where a rock shelf with 2.1 to 3 metre depth over it obstructs the channel. Navigation over the shelf is possible at high tides by vessels drawing up to 4.6 metres.

Depths in Baker Lake range from 31 to 84 metres, decreasing to 9.1 metres near the hamlet.

Tidal ranges vary from 5.2 metres near Centre Island in Chesterfield Inlet to negligible at Baker Lake settlement. The currents in Chesterfield Inlet can be strong, up to 5 knots. Navigation in Chesterfield Inlet, particularly through the Chesterfield Narrows and the north channel around Christopher Island, is difficult, although the route is marked with preliminary ranges. Approach to the harbour in Baker Lake is from the east-southeast, between the north shore and the Little Islands, and is encumbered with shoals.

The NTCL tug and barge provide service twice a year. The barges unload their fuel cargo at the three separate pipeline headers. The Transport Canada pipeline is located on the west coast of the Lake and runs to the airport tank farm. A second tank farm is located in the centre of town and is served by pipeline and header to the beach approximately one kilometre to the west of the landing wharf. Adjacent to the seaplane anchorage, a third tank farm east of the settlement receives petroleum products via pipeline and header running to the shoreline, 800 metres east of the landing wharf. An unidentified, irregular set of tanks exists just northwest of the landing wharf and appear to have a pipeline running to the shore approximately 130 metres east of the landing wharf. It would be served from a barge at the wharf.

The landing facility consists of a 50 metre long by 18 metre wide gravel approach, which is connected to an old rusting gravel filled Transport Canada barge which serves as the main wharf. The breasting face is 14 metres wide and the barge would berth bow on. There is 1.8 metres of water alongside at low tide. There are two shore anchors on each side of the wharf and approach to secure the barge.

The harbour is exposed to the east from the length of the Lake.

The landing site and structure are subject to some erosion and each season some fill is usually added to the approach or the wharf.

2.6 Coral Harbour

This settlement is located 64 degrees 8'N, 83 degrees 10'W, and is 848km north-northwest of Churchill, on the shore of Southampton Island of Hudson Bay (see Exhibits B-14, B-15 and B-16). The settlement is situated at the head of South Bay, on the west side of a cove called Coral Harbour. The actual facilities used for the resupply operation are located at Snafu Beach in Munn Bay, across the point of land 4.5km due west of Coral Harbour.

Coral Harbour has a mean tide of 2.5 metres and a large tide of 3.9 metres. The maximum tidal stream in the anchorage in Munn Bay is reported to be 2 knots. A marine/air radio beacon near the settlement assists in navigation.

Approaches to Munn Bay and the landing site for the resupply vessels are from the southwest, up Fisher Strait north of Coats Island, then north into South Bay, which is located roughly halfway along the south coast of Southampton Island, and from South Bay directly north into Munn Bay.

The barge moors off and discharges fuel to pipelines and five transfer tanks serving the Transport Canada airport tank farms. The landing area at Snafu Beach consists of an old gravel filled Transport Canada landing barge and gravel approach pier that extends about 30 metres from shore. Depth at the face is about .9 metre, and there are two shore anchors, one on each side of the wharf. The supply barge berths bow-on and uses large steel ramps to unload general cargo.

3. DESIRABLE IMPROVEMENTS

All of the facilities served by the NTCL operations have shortcomings and problems. Some are located on natural harbours, others are very exposed and most have very shallow water, reefs and very little in the way of a wharf or onshore facilities. With the exception of Baker Lake, all have to accommodate large tides. However, the present system of shipping cargos does work satisfactorily, with minor problems. It is a case of adapting to the environment rather than altering the environment. Some improvements are possible, with varying degrees of effort and cost.

The most basic improvements to be considered are, first, the frequency of service and, second, the shore facilities. Increased frequency of service would require as a minimum one additional tug and at least two additional barges. The need for more frequent service would have to be established; apparently the existing service enables the settlements to exist at an adequate level.

exhibit B-14

CORAL HARBOUR

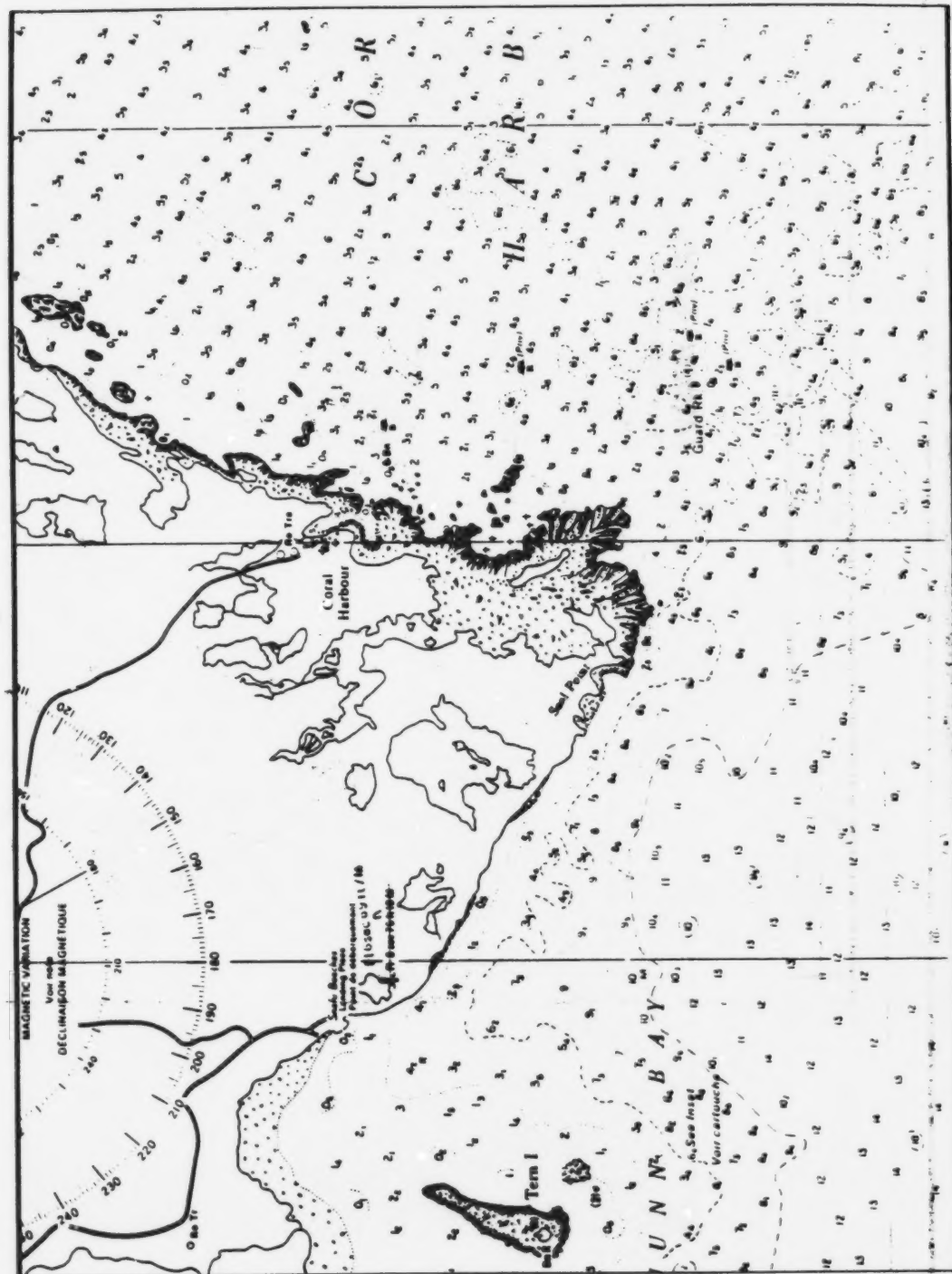


Exhibit B-15

CORAL HARBOUR LANDING SITE

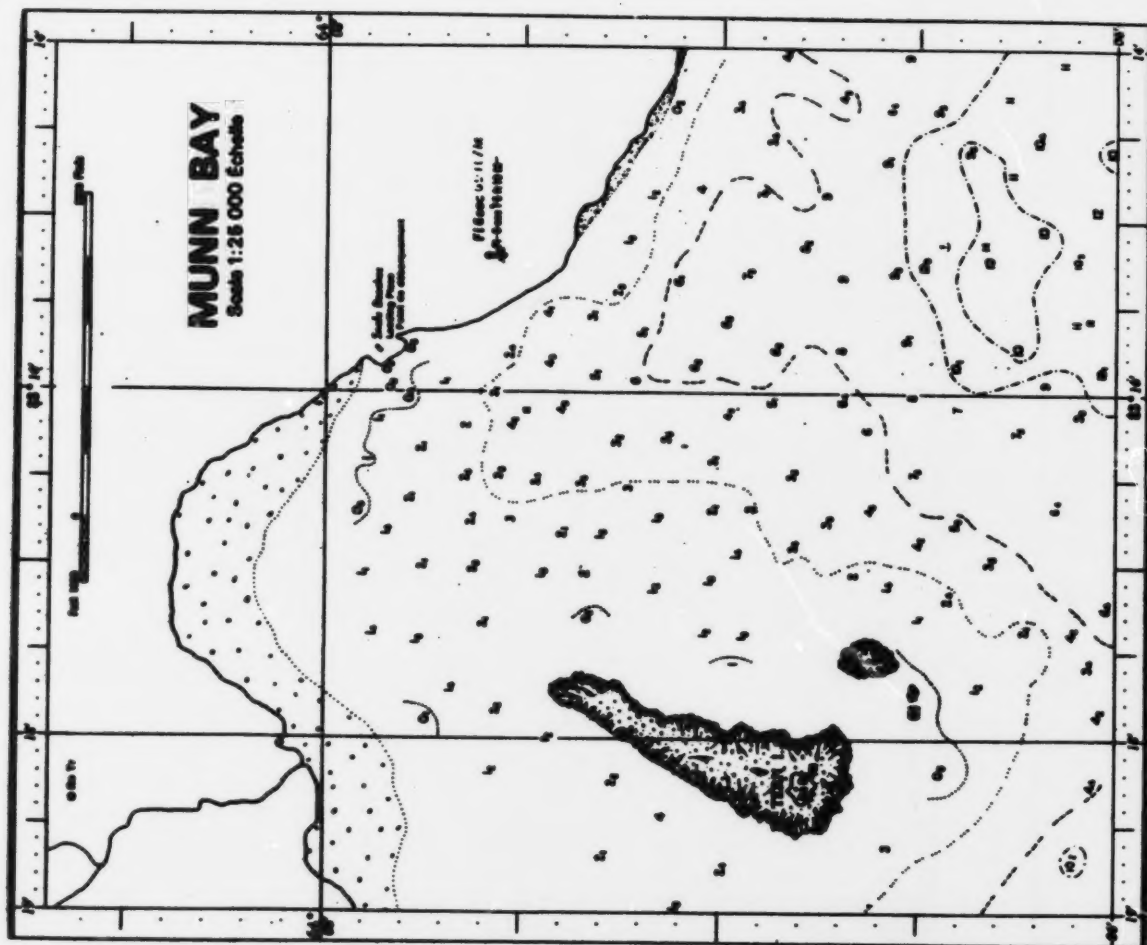


exhibit B-16

CORAL HARBOUR AERIAL PHOTO

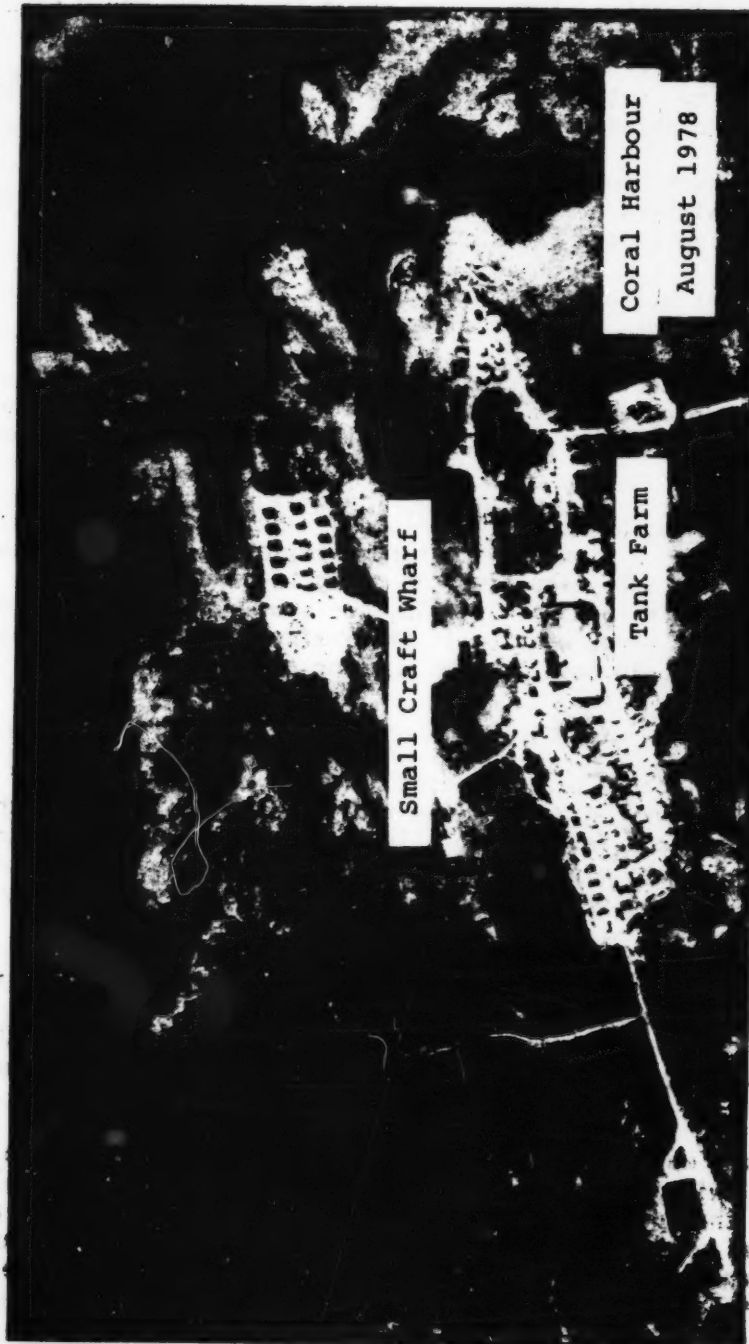


EXHIBIT B-16
Coral Harbour
August 1978
Small Craft Wharf
Tank Farm
Coral Harbour

The second consideration of improving shore facilities would have less of an impact on settlement existence. Improved facilities could possibly result in faster unloading and, hence, shorter trips, enabling one or two extra trips each season. It could also result in less damage to unloaded cargo.

In the case of both, improvements would be costly in both capital and operating (or maintenance) expenses and it is most doubtful if either could be justified on the basis of direct economic benefits.

Since the present system works, the greatest benefits to the individual ports might be derived from increased service.

The use of alternate types of vessels with drafts over 3 metres would present greater problems due to available water depths and the lack of mooring facilities. Baker Lake, due to its inland location, presents different problems.

At most of the sites bulk fuel is unloaded, and at most places at several locations. A flexible floating pipeline is used to transfer the cargo. It would be less time-consuming to consolidate the pipeline to a single loading manifold, preferably conveniently located alongside the main cargo wharf. If this is not feasible, then each pipeline header should have its own mooring point or wharf.

3.1 Eskimo Point

Eskimo Point is located on an exposed point on the west coast of Hudson Bay. However, because of the early season ice cover in the bay, and because this is traditionally the first resupply port to be called on in early to mid July, exposure does not normally create a problem. Arrivals later in the season may have some problem with the exposure.

There are numerous shoals and bars that make approaches difficult. Some dredging of the most hazardous is desirable, although installation of navigational aids would also alleviate some of the potential problems. The navigation buoys would have to be placed yearly.

The onshore and wharf facilities are acceptable in that they are used only once or twice a year by WTCL and they function satisfactorily. It was noted that during 1984 and a couple of years previously, a damaged vessel, the "Malita", was tied up at the wharf. This made unloading operations difficult so that they were moved elsewhere along the beach. Apparently, the vessel has now been moved. Onshore equipment is not available so all cargos must be handled by the barge's on-board equipment.

Larger vessels up to 3.5 to 4 metres draft using the port would require extensive dredging and a wharf to receive goods. Within the settlement some means of delivery would have to be devised. Minimum equipment would be a large forklift, a truck tractor, a flatbed trailer and some covered storage.

3.2 Whale Cove

Whale Cove is a small settlement which has no onshore facilities. It should have a pushout landing and, for speed of operations, it should have a shoreside open storage area. Without the marshalling area, cargo is delivered directly from the barge to the customer, which causes excessive delays of delivery.

Deeper draft vessels using the present site would require a channel to be dredged into the small bay landing site, or they would otherwise be dependent on the tides, in which case they would be grounded for a portion of the time. Shore based equipment would also be required to make deliveries to the customers.

3.3 Rankin Inlet

This harbour is sheltered and quite small. Large vessels would have difficulties maneuvering within the cove, particularly at low tides. Water depths within the cove run to 6.7 metres near the fuel header; however, most of the depth is less than 2.0 metres at low tide.

Dredging would ease NTCL operations, especially in the vicinity of the wharf. This would increase maneuverability of the tug and barges and result in decreased unloading time. It may also be possible to locate both barges within the cove for simultaneous unloading.

Larger vessels would require additional dredging to allow them to berth at the wharf for side unloading. They would also require a large turning basin, or allowances would have to be made to allow the vessel to back out directly into Prairie Bay. Shore based equipment and storage would also be required to make deliveries to the customers.

The wharf itself is adequately sized although it is reported to be deteriorating badly, and every spring requires at least ten loads of fill to restore it to acceptable conditions. The landing face is rock and twisted metal, requiring the use of ramps. It should be completely restored or rebuilt and upgraded where possible, including resurfacing, anchors, bollards, etc. If large vessels were going to use the facility, the wharf location and alignment would have to be adjusted to suit.

3.4 Chesterfield Inlet

Essentially, this settlement has no wharf at all; the barge is beached on the shore and the barge ramps are used to transfer cargo. A pushout landing at the level of the barge deck should be constructed. Currently, the incline of the barge ramps from the deck to the beach is very sharp since the barge is 4 metres high and the ramps are 10.7 metres long, which makes it difficult to unload.

The beach is quite shallow adjacent to the landing site. It would be beneficial to dredge and deepen the berth or, alternatively, extend a new wharf into much deeper water. This would be a necessity if deeper draft and larger vessels were to use the facilities.

The marshalling area on shore is not very large but, due to the methods of unloading, which are slower than normal, the area is adequate. If a better landing were to be constructed and unloading operations were increased, additional storage area would be required.

3.5 Baker Lake

Baker Lake is the only port located inland and navigation to the settlement is very long and difficult. One of the first improvements should be to upgrade the navigation aids along the route up Chesterfield Inlet and through the Narrows. Some dredging should be undertaken to deepen some of the shoals and cut channels. This is especially necessary if larger or deeper draft vessels are to use the facility.

Within the settlement the shoreline is composed of a beach several kilometres long. The various tank farms are located up and down the coast, requiring barges to moor at several locations to unload fuel. Consolidation of some of the pipeline headers would simplify and speed up unloading operations.

This is the only resupply port that has negligible tide and, as such, it would be advantageous to provide a wharf with deep water alongside such that the barges are never grounded. This would allow more flexibility in the unloading procedures and sequences. For example, barges could be unloading deck cargo before unloading bulk fuels.

Baker Lake receives considerable cargo and should have a relatively large wharf and storage area. It would be necessary to provide a full draft facility for larger vessels because there are no tides to allow clear passage over the shallows to and from the wharf. The wharf would have to be rebuilt and upgraded, especially if larger vessels are to use the facility. They would lie side to the wharf and would require bollards, fenders and a larger breasting face.

3.6 Coral Harbour

Coral Harbour is on the south coast of Southampton Island. It is very exposed to the south and some delays in shipping have been experienced due to rough weather. There is no shelter available within the anchorage in Munn Bay. Some form of breakwater, natural or man-made, would be desirable, although it may not be cost effective considering the port only receives one shipment a year from NTCL.

Unloading occurs at Munn Bay, several kilometres from the town site, which is a major inconvenience for the shippers, as they are required to deliver the goods directly to the consignee. Major improvements would include opening up the settlement to barge or resupply traffic. This would entail a major dredging program to open up the town wharf. However, this would also provide much better protection to vessels in port.

The approaches to the town are very difficult, with many shoals and rocks. Adequate navigation aids would also be a requirement. At present, only fuel is unloaded near the town site; the barges lie off shore and discharge through a floating pipeline.

4. SOURCES

Information and data on the Resupply Ports was obtained from:

- (1) Canadian Hydrographic Service Navigational Charts.
- (2) Government of NWT Fact Sheets.
- (3) Canadian Hydrographic Service, Sailing Directions, Labrador and Hudson Bay, Fifth Ed., 1983.
- (4) PWC Marine Architectural and Engineering Services Western Region Inspection of Barge Landing Site Keewatin District, NWT, June, 1984.
- (5) Interviews with Resupply Operators.
- (6) Department of Energy, Mines and Resources Aerial Photographs.

APPENDIX C

MANDATE OF THE EASTERN ARCTIC SEALIFT

APPENDIX CMANDATE OF THE EASTERN ARCTIC SEALIFT

The mandate for the Eastern Arctic Sealift as described in "Report of Eastern Arctic Sealift 1984" (TP 2506, Canadian Coast Guard, January 1985) is reproduced below:

1. AUTHORITY

1.1 Treasury Board Mandate

The coordination of the 1984 Sealift of the Eastern Arctic was conducted by Fleet Systems Branch, Canadian Coast Guard, under the authority of Treasury Board (T.B. 776851, July 2, 1981). The Board approved the renewal of mandate for the period FY 1982-83 to FY 1986-87 inclusive.

The approval was subject to a review during FY 1985-86 of the desirability of responding to the proposal of the Government of the Northwest Territories to establish a Northwest Territories based Development Corporation to assume the role of coordinating the Federal Sealift in FY 1987-88.

1.2 Memorandum of Understanding CCC/CCG

Included in the mandate was the requirement of the United States Government. Through a Memorandum of Understanding between the Canadian Commercial Corporation (CCC) and the Department of Transport the Department undertook to perform the work as set out in the contract between the United States Air Force (USAF) and the Canadian Commercial Corporation in such a manner as to enable the CCC to fulfill its obligations to the USAF under the said contract.

2. FUNCTIONS OF THE TRANSPORTATION COORDINATOR FOR THE EASTERN ARCTIC RESUPPLY

2.1 Pre-season Preparation

The Transportation Coordinator shall:

1. Chair pre-season meetings not later than December 1, each year to discuss with major shippers problems of the previous sealift and plans for the coming operation.
2. Disseminate sealift information to present and potential users and contact all known shippers to give them general sealift information, booking deadlines and a supply of the cargo booking form, not later than January 2, of each year.
3. Design and implement such standard forms and procedures as are required for the systematic control of the operation; these include, cargo booking form, shipping schedules, instructions to shippers and carriers, invoices and collection letters.

4. Maintain statistics of cargo booked as follows:

Phase I - Cargo Booked

- (a) Port of Loading
- (b) Port of Discharge
- (c) Customer
- (d) Commodity (20)
- (e) Weight (Actual)
- (f) Volume (Actual and Assigned)
- (g) Description

Phase II - Cargo Shipped

- (a) Document Number (Carrier)
- (b) Customer
- (c) Port of Loading
- (d) Port of Discharge
- (e) Vessel
- (f) Weight or Measurement (Billing purposes)
- (g) Description
- (h) Weight
- (i) Volume

- 5. Prepare tender specifications in accordance with principles agreed to by the Eastern Arctic Resupply Working Group or as directed by the Eastern Arctic Resupply Policy Group.
- 6. Comply with the Government Contract Regulations.
- 7. Evaluate bids and choose the successful bidder.
- 8. Draw up contracts with the shipping companies, with appropriate legal advice and in accordance with principles as agreed to by the working Group or as directed by the Policy Group.
- 9. Ensure resupply ships are, as far as possible, self-sufficient as to fuel and water so that they shall not make unwarranted demands on the Coast Guard resources.
- 10. Advise all clients via copy of a completed non-negotiable cargo booking form of the agreed receiving dates, shed number and approximate sailing date as soon as these are known.

Part II - Sealift Operation

- 11. Call for final tonnage figures by a specified deadline date (declaration date).
- 12. Where possible, attempt to place cargo booked after declaration date at contract rates or, otherwise, at the lowest rate available outside of any existing contract.

13. Arrange the movement of American cargo from the port(s) they choose and shall integrate this cargo with Canadian cargo movements to the extent feasible and economical.
14. Negotiate operational changes, cargo priorities, schedule changes, vessel substitution, etc., with the carriers. Clients requiring such changes shall channel them through the Coordinator, who will endeavour to implement them.
15. Appoint a representative to facilitate loading cargo at Montreal (or port of exit).
16. Provide certificated Home Trade Masters, with experience in Arctic waters, to promote safe anchoring/docking of ships in the North, to advise shipmasters of conditions at various ports and to facilitate cargo discharge by every possible means.
17. Provide support and contingency equipment, such as barges, sea hose, pumps, etc., as deemed necessary to assist commercial carriers during the operation of discharging cargoes to above the high water mark or in the case of bulk P.O.L. to the tank pipeline.
18. Arrange for stevedoring and agency services, "ON" and "OFF" Hire Surveys, tank cleaning and inspection, etc.
19. Require the carriers to employ local residents wherever possible in the cargo discharge operation.
20. Establish liaison with the Water Transport Committee of C.T.C., and with the Customs and Excise, National Revenue, as necessary to ensure Coasting Regulations are followed.
21. Maintain continuous liaison with the Director General, Fleet Systems of the Canadian Coast Guard, to ensure resupply ships are scheduled to minimize the demands on the icebreaking/escorting facilities.
22. Institute and maintain a communication service that will be used to monitor ship movements and the progress of the sealift.
23. Have a person available at all times to discuss sealift problems. Procedure for communicating will be provided prior to the commencement of the shipping season.

Part III - Post-Season Activity and Analysis

24. Be responsible for all payments to the shipping companies.
25. Process loss or damage claims as required.
26. Undertake post sealift analysis and develop remedial recommendations for Working Group consideration and approval so that they can be tabled at the next pre-season meeting for implementation.

3. EASTERN ARCTIC RESUPPLY - RESPONSIBILITIES OF SHIPPERS

Shippers using the MOT coordinated Eastern Arctic Resupply service will:

1. Designate a person who will represent the interests of his department, agency or company, etc.; who will coordinate cargo bookings and, where applicable, act as liaison with representatives at northern sites to protect and promote the interests of northern residents in respect to cargo booked and shipped and ensure that the representatives are provided with early and adequate booking information. These designated persons will work closely with the Transportation Coordinator and will advise of any special shipping requirements for their respective departments or agencies.
2. Consolidate requirements for space for government cargoes based on capital construction and operational needs.
3. Submit in memorandum form by the date established by the Transportation Coordinator, the anticipated tonnages to be shipped.
4. Provide consolidated cargo bookings, fully completed and signed, to the Transportation Coordinator by stated deadlines.
5. Book all sealift cargo with the Transportation Coordinator and shall not make any private or separate shipping arrangements without obtaining the permission of the Transportation Coordinator.
6. Provide prompt detailed updating of cargo booking forms, as necessary.
7. Discuss desired receiving and sailing dates with the Transportation Coordinator.
8. Arrange for cargoes to be available on the dock of the shipping company in sufficient time to permit loading for the scheduled sailing date.
9. Ensure all shipments are properly documented and are marked as to weight, destination, consignee and adequately packaged for shipment by sea to the Arctic.
10. Inform the Transportation Coordinator of any departmental representative(s) who may require transportation and messing in the commercial ships.
11. Arrange for receiving, examining and signing for all cargo discharged to above high water mark and for the movement of cargo from high water mark to final destination, as may be required.

12. Arrange, as required, to have a designated representative gauge tanks, check valves and lines at bulk fuel tanks, arrange for hook-up of sea hose and monitor gallonage delivered and sign for same. The integrity of the receiving system for the point of connection of the sea hose is the responsibility of the designated representative.
13. Consolidate and verify all data relating to the respective loss and/or damage claims and present them to the Transportation Coordinator in accordance with the non-negotiable cargo booking form, providing witnesses and evidence of loss or damage as required to substantiate such claims.
14. Promptly reimburse the Transportation Coordinator, as billed, for cargo shipped upon evidence that the invoices are correct.

4. TASK

The Department's task was to act as the exclusive Coordinator for the Department of National Defence (DND), Department of Indian and Northern Affairs (DINA), Government of the Northwest Territories (GNWT), and all other Federal Departments and agencies, and for the USAF, for the assembly, transportation and delivery of all cargoes to the Eastern Arctic including Arctic Quebec, but excluding the Keewatin District.

To perform the same function for Provincial, Commercial and Private concerns and Individuals requiring the service. To transport the cargo by Commercial Carriers wherever possible and practical, and where this is not practical, the Coast Guard vessels may be used.

To recover from all clients served, the direct costs of the transport service provided.

5. ORGANIZATION

The Department, in the role of Coordinator, contracted with the shippers to arrange on their behalf, for the movement of cargo from Ogdensburg, N.Y. (USAF only) and Montreal, to Arctic sites, between Arctic sites (lateral cargo) and from Arctic sites to Montreal (MTL) and Ogdensburg (Ogd) (retrograde cargo).

6. COORDINATOR

The "Functions of the Transportation Coordinator (Cargo Superintendent, Fleet Systems, CCG) for the Eastern Arctic Sealift" and the "Responsibilities of Shippers, Eastern Arctic Sealift" are listed in the previous section.

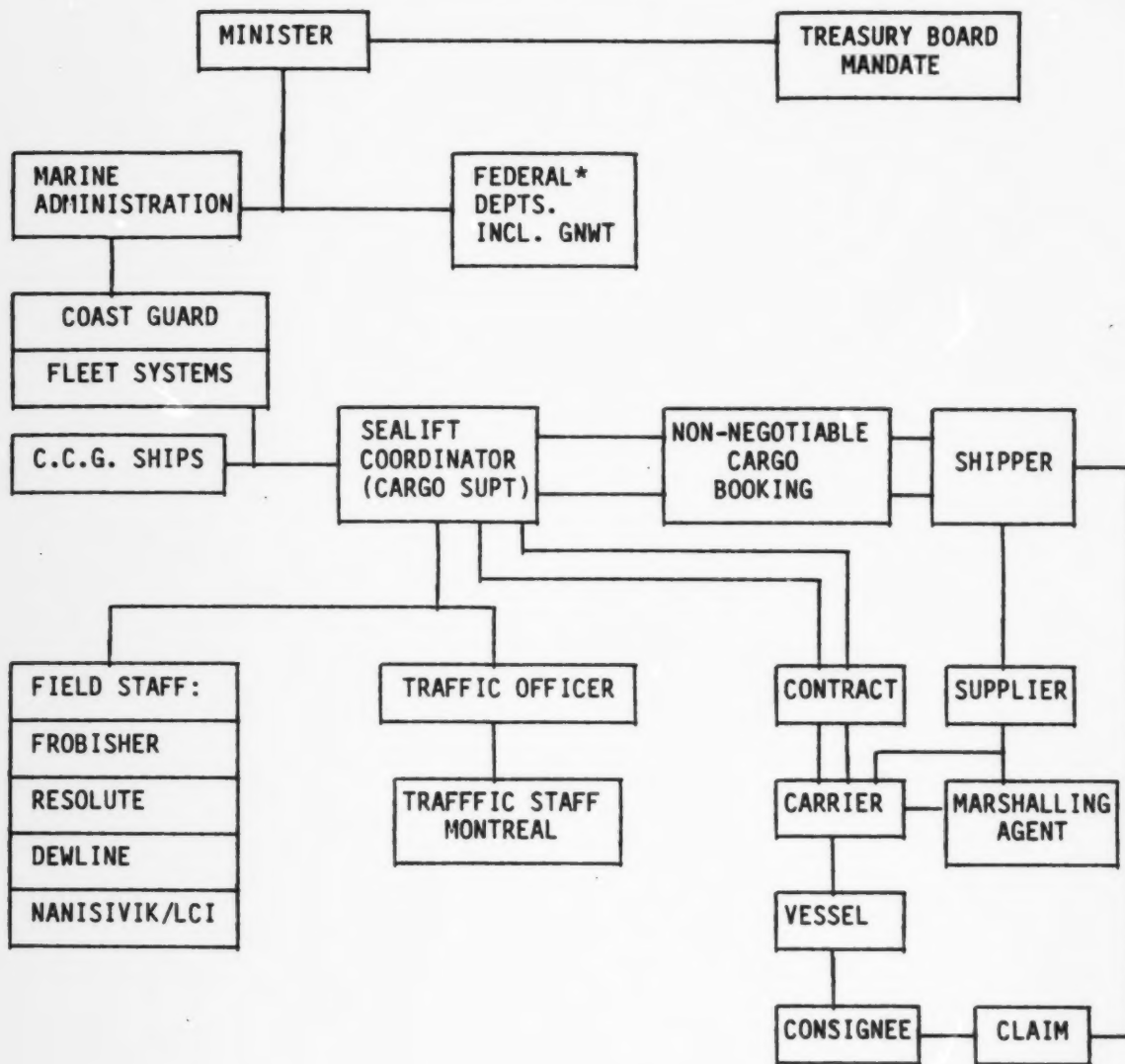
7. DRY CARGO

The Department contracted with Marine Carriers for the receiving and warehousing of cargo, loading of vessels and the transportation and delivery of cargo to above the high water mark at the various sites,

also for the movement of cargo between Arctic sites and from Arctic sites to Montreal. Areas and Discharge sites are shown at overleaf. The Carriers bid on a rate per tonne weight or measurement, i.e., 1,000 kg or 2.5m³, and were paid on weight or measurement, whichever produced the greater revenue. All costs paid to the Carriers are fully recoverable under the terms of the Non-Negotiable Cargo Booking between the Department and the Shippers.

C-7

EASTERN ARCTIC SEALIFT SYSTEM



* Functional Direction

APPENDIX D

AIR INVENTORY INFORMATION

CARRIERS LICENSED TO OPERATE ATNORTHWEST TERRITORIES AIRPORTS

Aklavik, N.W.T.	Aklavik Flying Service Limited Kenn Borek Air Ltd. Ram Air Charter Limited
Arctic Bay, N.W.T.	Kenn Borek Air Ltd. First Air
Baker Lake, N.W.T.	Calm Air
Belcher Islands, N.W.T.	Air Inuit
Broughton Island, N.W.T.	First Air
Cambridge Bay, N.W.T.	Northwest Territorial Pacific Western Airlines Ltd. Cameron Bay Air Adlair Aviation
Chesterfield Inlet, N.W.T.	Calm Air
Clyde River, N.W.T.	First Air
Coppermine, N.W.T.	Northwest Territorial Airway Ltd. Kenn Borek Air Ltd.
Coral Harbour, N.W.T.	Calm Air First Air
Cullaton Lake, N.W.T.	Calm Air
Eskimo Point, N.W.T.	Calm Air
Eureka, N.W.T.	Bradley Air Services Limited
Frobisher Bay, N.W.T.	Bradley Air Services Limited First Air Greenlandair Inc. Nordair Ltd. Northwest Territorial Airways Ltd.
Gjoa Haven, N.W.T.	Northwest Territorial Airways Ltd. Kewatin Air Limited
Grise Fiord, N.W.T.	Kenn Borek Air Ltd.
Hall Beach, N.W.T.	Bradley Air Services Limited First Air Nordair Ltd. Northwest Territorial Airways Ltd.

Holman Island, N.W.T.	Northwest Territorial Airways Ltd. Ken Borek Air Ltd.
Igloolik, N.W.T.	First Air
Inuvik, N.W.T.	Aklak Air Ltd. Aklavik Flying Service Limited Antler Aviation Ltd. Inuvik Coastal Airways Ltd. Kenn Borek Air Ltd. Nahanni Air Services Inc. Pacific Western Airlines Ltd. Ram Air Charter Limited Trans North Air
Lake Harbour, N.W.T.	First Air
Nanisivik, N.W.T.	First Air Kenn Borek Air Ltd. Nordair Ltd.
Paulatuk, N.W.T.	Aklavik Flying Service Limited Kenn Borek Air Ltd.
Pelly Bay, N.W.T.	First Air Northwest Territorial Airways Ltd. Keewatin Air Limited
Pond Inlet, N.W.T.	First Air Kenn Borek Air Ltd.
Rankin Inlet, N.W.T.	Calm Air Keewatin Air Limited Northwest Territorial Airways Ltd.
Repulse Bay, N.W.T.	Calm Air First Air
Resolute Bay, N.W.T.	Bradley Air Services Limited Ken Borek Air Ltd. Nordair Ltd. Pacific Western Airlines Ltd.
Sachs Harbour, N.W.T.	Aklavik Flying Services Limited Kenn Borek Air Ltd.
Spence Bay, N.W.T.	Northwest Territorial Airways Ltd. Keewatin Air Limited
Tuktoyaktuk, N.W.T.	Aklavik Flying Services Limited Kenn Borek Air Ltd. Ram Air Charter Limited
Whale Cove, N.W.T.	Calm Air

Yellowknife, NW.T.

Aero Arctic Ltd.
Air Providence Ltd.
Bathurst Inlet Air Services
Calm Air
La Ronge Aviation Services Ltd.
Latham Island Airways Ltd.
Norcor Engineering & Research Ltd.
Northwest Territorial Airways Ltd.
Pacific Western Airways Ltd.
Ptarmigan Airways Ltd.
Raecom Air Limited
Sioux Narrows Airways Ltd.
Spur Aviation Ltd.
Turn-Air Ltd.
Yellowknife Air Services Ltd.

EXHIBIT D-1

PORT OF CHURCHILL STUDIES

AIR TRANSPORTATION SERVICES

COMMUNITY	OPERATOR	AIRCRAFT TYPES	ORIGIN	TRANSIT POINTS	FARES*	SERVICE FREQUENCY
BAKER LAKE (YBK)	Calm Air (MO)	HS7	Churchill (YYQ)	2	293.	Mon.(2), Wed.(2), Fri.
	Calm Air (MO)	HS7	Eskimo Point (YEX)	1	203.	Mon.(2), Wed.
	Calm Air (MO)	DHT, HS7	Rankin Inlet (YRT)	1	172.	Mon.(2), Tues., Wed., Thurs., Fri.
	Calm Air (MO)	HS7	Thompson, Man. (YTH)	3		Mon.
CHESTERFIELD INLET (YCS) CHURCHILL	Calm Air (MO)	HS7	Rankin Inlet (YRT)	1	95.	
	Calm Air (MO)	HS7	Baker Lake (YBK)	2	293.	Mon.(2), Tues., Wed.(2), Fri.
	Calm Air (MO)	HS7	Coral Harbour *YZS)	1	364.	Thurs.
	Calm Air (MO)	HS7, DHT	Eskimo Point (YEX)	0	165.	Mon., Tues., Wed., Thurs., Fri.
	PW	73S	Gilliam, Man. (YGX)	0	78.	Mon., Wed., Fri.
	Calm Air (MO)	HS7	Rankin Inlet (YRT)	2	242.	Mon., Tues.(2), Wed., Thurs.(2), Fri.
	Calm Air (MO)	HS7	Repulse Bay (YUT)	2	413.	Tues., Thurs.
	Calm Air (MO)	HS7	Thompson, Man. (YTH)	0		Mon.
	AC, PW	72S, 73S	Toronto, Ont. (YYZ)	1		Mon., Wed.
	PW	73S	Winnipeg, Man. (YWG)	1	192.	Mon., Wed., Fri.
	First Air (7F)	HS7	Broughton (YWM)	0	158.	Mon., Wed.
	First Air (7F)	HS7	Frobisher Bay (YFB)	1	269.	Mon., Wed.
CLYDE RIVER	First Air (7F)	HS7	pond Inlet (YIO)	0	158.	Tues., Thurs.
	Calm Air (MO)	HS7	Churchill (YYQ)	1	364.	Tues.
	First Air (7F)	HS7	Cape Dorset (YTE)	0	138.	Fri.
	First Air (7F)	HS7	Frobisher Bay (YFB)	1	248.	Fri.
CORAL HARBOUR	Calm Air (MO)	HS7	Rankin Inlet (YRT)	0	234.	Tues.
	First Air (7F)	HS7	Repulse Bay (YUT)	0	174.	Thurs.
	Calm Air (MO)	HS7	Baker Lake (YBK)	1	203.	Mon., Tues., Wed., Fri.
	Calm Air (MO)	HS7, DHT	Churchill (YYQ)	0	165.	Mon.(2), Wed., Fri.
ESKIMO POINT	Calm Air (MO)	HSy, DHT	Rankin Inlet (YRT)	1	145.	Mon., Tues., Thurs., Fri.
	Calm Air (MO)	HS7	Thompson, Manitoba (YTH)	1	190.	Mon.
	Calm Air (MO)	HS7	Resolute (YRB)	1		
	Kenn Borek Air Ltd.	(4K)		1		

* One way - no excursion

EXHIBIT D-1

PORT OF CHURCHILL STUDIES

AIR TRANSPORTATION SERVICES (Cont'd)

COMMUNITY	OPERATOR	AIRCRAFT TYPES	ORIGIN	TRANSIT POINTS	FARES*	SERVICE FREQUENCY
HALL BEACH (YUX)	Nordair (ND)		Montreal (YUL)	2	509.	Wed., Sat.
	Northwest Territorial Airways (NV)		Cambridge Bay (YCB)	3	614.	Wed.
IGLOOLIK (YGT)	Nordair (ND)	73M	Ft. Chimo, Quebec (YYP)	1	331.	Wed., Sat.
	(NV)	73M	Frobisher Bay (YFB)	0	223.	Wed., Sat.
	First Air (7F)	D3M	Gjos Haven (YHK)	2	335.	Wed.
	First Air (7F)	DHT	Igloolik (YGT)	0	67.	Mon., Wed., (2), Sat., (2)
	First Air (7F)	D3M	Pelly Bay (YBB)	0	139.	Wed., (2)
	First Air (7F)	DHT	Pond Inlet (YIO)	1	183.	Mon.
	First Air (7F)	DHT	Repulse Bay (YUT)	1	136.	Wed.
	(NV)	D3M	Spence Bay (YYH)	1	263.	Wed.
	(NV)	LOM, D3M	Yellowknife (YZF)	3	682.	Wed.
	First Air (7F)	DHT	Nanisivik (YSR)	2	196.	Mon.
	First Air (7F)	DHT	Hall Beach (YUX)	0	67.	Mon., Wed., (2), Sat., (2)
	First Air (7F)	DHT	Nanisivik (YSR)	1	157.	Mon.
PELLY BAY (YBB)	First Air (7F)	DHT	Pond Inlet (YIO)	0	146.	Mon.
	(NV)	D3M	Cambridge Bay (YCB)	2	486.	Mon., Wed.
	(NV)	D3M	Coppermine (YCO)	3	710.	Mon.
	(ND) (NV)	d/m	Frobisher Bay (YFB)	0		Wed.
	(NV)	D3M	Gjos Haven (YHK)	1	196.	Mon., Wed.
	(NV) (7F)	D3M, DHT	Hall Beach (YUX)	0	139.	Wed., (2)
	(ND) (NV)	D3M, 73M	Montreal (YUL)	2	599.	Wed.
	First Air (7F)	DHT	Repulse Bay (YUT)	0	118.	Wed.
	(NV)	D3M	Spence Bay (YYH)	0	124.	Mon., Wed.
	(NV)	D3M	Yellowknife (YZF)	4	647.	Mon., Wed.
POND INLET (YIO)	First Air (7F)	HS7	Broughton (YWM)	1	260.	Mon., Wed.
	First Air (7F)	HS7	Clyde River (YCY)	0	158.	Mon., Wed.
	First Air (7F)	HS7	Frobisher Bay (YFB)	2	348.	Mon., Wed.
	First Air (7F)	DH7	Hall Beach (YUX)	1	183.	Mon.

* One way - no excursion

EXHIBIT D-1

PORT OF CHURCHILL STUDIES

AIR TRANSPORTATION SERVICES (Cont'd)

COMMUNITY	OPERATOR	AIRCRAFT TYPES	ORIGIN	TRANSIT POINTS	FARES*	SERVICE FREQUENCY
POND INLET (YIO) Cont'd	First Air (7F)	DHT	Iqloolik (YGT)	0	146.	Mon.
	First Air (7F)	DHT	Nanisivik (YSR)	0	106.	Mon.
RANKIN INLET (YRT)	Calm Air (MO)	HS7, DHT	Churchill (YYQ)	YYQ	242.	Mon.(2), Tues., Wed., Thurs., Fri.
	Calm Air (MO)		Baker Lake (YBK)	1	172.	Mon., Tues.(2), Wed., Thurs., Fri.(2)
	NV, PW	LOM, 735	Calgary (YYC)	3	610.	Tues., Fri.
	Calm Air (MO)	HS7	Coral Harbour (YZS)	0	234.	Thurs.
	AC, NV, PW	D95, LOM				
		735	Edmonton (YEG)	2	610.	Tues.(2), Thurs., Fri.
	Calm Air (MO)	HS7, DHT	Eskimo Point (YEX)	1	145.	Mon.(2), Fri.
	(NV)	LOM	Frobisher Bay (YFB)	0	444.	Tues., Thurs.
	CP, NV	737	Montreal (YUL)	0	612.	Tues., Thurs.
	AC, NV, CP	725, LOM				
		737	Ottawa (YOW)	1	599.	Tues.(2), Thurs.(2)
	Calm Air (MO)	HS7	Repulse Bay (YUT)	1	242.	Tues., Thurs.
	Calm Air (MO)	HS7	Thompson (YTH)	2	254.	Mon.
	AC, NV	725, LOM	Toronto (YYZ)	0	583.	Tues., Thurs.
	NV	LOM	Winnipeg (YWG)	0	430.	Tues., Thurs.
	NV	LOM	Yellowknife (YZF)	0	408.	Tues.(2), Thurs., Fri.
REPULSE BAY (YUT)	Calm Air (MO)	HS7	Churchill (YYQ)	2	413.	Tues., Thurs.
	First Air (7F)	DHT	Hall Beach (YUX)	1	136.	Wed.
	First Bay (7F)	DHT	Pelly Bay (YBG)	0	119.	Wed.
	Calm Air (MO)	HS7	Rankin Inlet (YRT)	1	242.	Tues., Thurs.
RESOLUTE (YRB)	PW	734	Edmonton (YEG)	1	438.	Wed., Sat.
	ND	734	Frobisher Bay (YFB)	0	363.	Tues., Fri.
	Nordair (ND)	DHT	Montreal (YUL)	1	642.	Tues., Fri.
	4K	DHT	Nanisivik (YSR)	0		Thurs.
	4K	DHT	Pond Inlet (YIO)	1		Thurs.
	PW	734	Yellowknife (YZF)	0	286.	Wed., Sat.

* One way - no excursion

EXHIBIT D-1

PORT OF CHURCHILL STUDIES

AIR TRANSPORTATION SERVICES (Cont'd)

COMMUNITY	OPERATOR	AIRCRAFT TYPES	ORIGIN	TRANSIT POINTS	FARES*	SERVICE FREQUENCY
SPENCE BAY (YYH)	NV	D3M	Cambridge Bay (YCB)	1	396.	Mon., Tues., Wed., Thurs., Fri.
	NV	D3M	Coppermine (YCO)	2	552.	Mon.
	NV, ND	D3M, 73M	Frobisher Bay (YFB)	1		Wed.
	NV	D3M	Gjoa Haven (YHK)	0	99.	Mon., Wed., Thurs., Fri.
	NV	D3M	Hall Beach (YUK)	1	263.	Wed.
	NV, ND	D3M, 73M	Montreal (YUL)	2		Wed.
	NV	D3M	Pelly Bay (YBB)	0	124.	Wed.
	NV	LOW, D3M	Yellowknife (YZF)	1	558.	Mon., Wed., Fri.
			Churchill (YYQ)	Rankin Inlet		
	Calm Air (MO)					
WHALE COVE						

* One way - no excursion

AIRCRAFT TYPE LEGEND

72S - Boeing 727-200
 73S - Boeing 737-200/200C & 300 series
 73M - Boeing 737-200 Mixed Passenger/Freighter
 DHT - deHavilland of Canada DHC6 Twin Otter
 D3M - McDonnell Douglas DC3/Dakota C47
 D9S - McDonnell Douglas DC9-30, 40, 50 & 80 series
 HS7 - Hawker Siddeley 748 (all series)
 LOW - Lockheed Electra L188 Mixed Configuration

APPENDIX E

SEALIFT BULK FUEL COSTS

EXHIBIT E-1

SEALIFT BULK FUEL COSTS

VESSEL	AREA SERVED	\$ PER DIEM	TOTAL DAYS	SAIL DAYS	PORT DAYS	TOTAL PER DIEM	INSURANCE	FUEL	TOTAL	TONNES LOADED**	SHIP COST	
											\$/TONNE	\$/DAY
Lechane #1	B/E/O	18,180	56	39	17	1,018,080	153,135	151,466	1,322,681	12,627	104.75	23,619
MT James*	E/O	15,485	41	20	21	634,885	95,497	94,456	824,837	2,944	280.18	20,118
Ungavat	B	13,450	41	24	17	551,450	82,947	82,043	716,439	5,563	128.79	17,474
LeSaulle #1	E/F/O	16,110	40	32	8	644,400	96,928	95,871	837,199	7,234	115.73	20,930
LeCadre #1	C/E	16,390	29	19	10	475,310	71,494	70,715	617,519	7,758	79.60	21,294
TOTAL			207	134	73	3,324,125	500,000	494,550	4,318,675	36,126	119.54	20,863
\$/tonne						92.01	13.84	13.69	119.54			
\$/day						16,059	2,415	2,389	20,863			
TOTAL (excl. MT James)			166	114	52	2,689,240	404,503	400,094	3,493,838	33,182		
\$/tonne						81.05	12.19	12.06	105.29			
\$/day						16,200	2,437	2,410	21,047			

* Refuelling Coastguard Vessels - Small Volumes

** Tonnes discharged slightly less (36,001 in total)

SOURCE: Eastern Arctic Sealift 1984 Report
Estimates of Insurance and Ships Fuel

APPENDIX F

MINERAL EXPLORATION AND DEVELOPMENT IN THE
CENTRAL ARCTIC AND KEEWATIN REGIONS

APPENDIX FMINERAL EXPLORATION AND DEVELOPMENT
IN THE CENTRAL ARCTIC AND KEEWATIN REGIONS

A comprehensive report, Mineral Exploration and Development in the Central Arctic - Keewatin Region (recent trends and future situations with and without the Polar Gas Project) was prepared as part of the Polar Gas Socio-Economic Program by Andrew J. Frayman and Ian D. Wilson of the firm Minec-consult Limited, in 1977.

The Report identified five areas of favourable geological environments as follows:

- o Arctic Islands Paleozoics;
- o Boothia Peninsula/Sommerset Island area;
- o Prince Albert Group belt;
- o Central Keewatin area;
- o Ennadai-Rankin Group.

Two of these groups, the Arctic Islands Paleozoics and the Boothia Peninsula/Sommerset Island area probably lie outside the potential marine resupply zone of Churchill unless the ore were to be processed in Manitoba. Direct marine access would necessitate navigation through the hazardous Fury and Hecla Straits; superior but longer marine access exists from the west through McClure Strait and Melville Sound and from the east through Davis Strait and Lancaster Sound. Marine resupply from Churchill via the latter route would require navigation through Hudson Bay, around Baffin Island and through Davis Strait, Baffin Bay and Lancaster Sound. This is a very indirect route and would not likely be economic. However, air resupply from Churchill to both zones would be a consideration.

The Prince Albert Group belt stretches for approximately 500 kilometres in an east/west direction from the Melville Peninsula westward. The three more favourable mineral deposits, two iron and one nickel, are located on the Melville Peninsula. Two of the three sites are close to Foxe Basin and these could be resupplied by water from Churchill. The third site is on the Community Bay side of the Peninsula and would normally be better served from the Western Arctic. Marine access to the area is severely restricted from either the west or the east. Marine service from the east coast would require construction of a 120 kilometre long road across the Rae Isthmus.

Four of the remaining five mineralized zones lie near the northern coast line and would be best served from the Western Arctic. The fifth mineralized zone lies further inland, an equal distance from east or west marine access. All deposits identified within the belt could be served by air from Churchill. Marine resupply of the Central Keewatin area could be achieved through Baker lake. Five of the seven deposits explored to date lie in close proximity to Baker Lake and Chesterfield Inlet; the closest is located approximately 60 kilometres from Baker Lake and the second closest approximately 150 kilometres.

The Ennadai/Rankin Group of deposits stretches from Hudson Bay to a point approximately 300 kilometres east of Rankin Inlet. A former nickel mine at Rankin Inlet was resupplied from Churchill by water. However, the Cullaton Lake goldmine which lies in the southwest region of the zone was entirely resupplied by air, primarily from Churchill but with some services from Thompson, Manitoba.

The most favourable mineralized areas from the point of view of marine resupply from Churchill are Ennadai/Rankin belt, the Central Keewatin zone, and the Melville Peninsula prospects of the Prince Albert Group.

The following is a brief description of geological formations and exploration/mining activities in the various areas:

The Ennadai/Rankin Green Stone Belt

This belt is comprised of volcanic and elementary rocks of the Archeon, trending northeasterly from Ennadai Lake to Rankin Inlet. It is considered a prime target for gold and base metals and has had two producing mines; a nickel mine at Rankin Inlet and a gold mine at Cullaton Lake. The Rankin nickel deposit has been mined out and the Cullaton Lake mine was closed in August and is reopening dependent on higher gold prices. The North Rankin nickel mine was in production during 1957 to 1962. A total of 458,000 tonnes of ore was milled, producing 9,670 tonnes of nickel and 2,634 tonnes of copper. It is unlikely that the mine was ever profitable. The mine is considered depleted and the likelihood of additional nickel discoveries in the immediate vicinity of the original ore body is considered to be unlikely.

The Cullaton Lake gold property is located 150 miles west of Eskimo Point and 400 kilometres northwest of Churchill, Manitoba. It has an airstrip of 325 metres by 60 metres and access by wheeled, float and ski aircraft is possible. The discovery was made in 1961 and exploration continued until 1973. Development of the mine site commenced in 1974. It closed in 1985.

Other possibilities in the area include:

- o The Ferguson Lake nickel deposit;
- o A nickel copper deposit investigated by the Canadian Nickel Company in the '50s is located approximately 250 kilometres due west of Rankin Inlet. The status of the deposit is not known, but metal recovery is believed to be difficult and at the time of the exploration activity the company considered the area to be too remote for development.

Heninga Lake Copper/zinc Deposit

This prospect is located on the southeastern part of Heninga Lake. The property is under option to St. Joseph's Exploration Limited from Gemax Minerals Incorporated. The results from ground geophysical surveys and six exploratory holes indicate an ore body rating of 0.9% copper, 6.8% zinc and 3.1 oz. of silver per ton and minor amounts of lead. St. Joseph's and six other companies and individuals acquired some 714 claims in 30 blocks surrounding the prospect covering an area of approximately 8 to 9 kilometers in width and 19 kilometres in length.

There are also numerous indications of magnetite deposits and the Maguse Lake-Wallace River belt of magnetic anomaly is considered to have good potential for the occurrence of one or two medium sized (200,000,000 to 700,000,000 tonnes) Algoma-type iron ore deposits. Another laminated quartz-amphibole magnetic iron formation is located 8 kilometres east northeast of Erbell Lake (60 degrees 12.5 minutes north and 98 degrees 0.25 minutes west); there is a major magnetic anomaly suggesting a southeast continuation to northern Baralzon Lake.

Central Keewatin Uranium Area

The Central Keewatin uranium area is centered on Dubawnt Lake, Aberdine Lake, Baker Lake and Dubawnt Cassand River.

During 1971 and 1972, major activity in the area was shown by Pan Ocean Limited, Republic Resources Limited and Aquitaine of Canada Limited. Aquitaine discovered interesting uranium prospects and deposits in the Amer Lake area and Pan Ocean in the Baker Lake area. In 1975, Cominco Limited optioned the Pan Ocean holdings and carried out extensive exploratory work at Cassand Falls, Christopher Island and the mainland north of Christopher Island. The Amer Lake uranium deposit was stated by Aquitaine to be sub-economic.

During 1975, explorations were carried out west of Yathkyee Lake, by Shell Canada Limited and Urangesellschaft Canada Limited. Also Rio Exploration Limited obtained one prospect permit located southwest of Baker Lake and east of Mallory Lake in 1975. Union Oil has optioned into the Rialto property and Brascan Resources had three prospecting permits in 1976 located north of Shults Lake and southwest of Amer Lake.

The occurrence of Dubawnt Group basalts unconformably overlying basement rocks over extensive areas of Central Keewatin is somewhat analogous to the situation in Northern Saskatchewan, a favourable area for uranium deposits. The Central Keewatin prospects and deposits can be classified according to the host rock environment as follows:

- o Basement rocks - Amer Lake, Cassand Falls mainland north of Christopher Island;
- o Dubawnt Group - Cassand Formation - northwest of Bisset Lake, Central Christopher Island.
- o Christopher Island volcanics - northwest of Christopher Island.

The outlook in 1976 was considered favourable by the exploration companies involved. There has been a considerable drop in uranium prices since that time and the current outlook is believed to be much less favourable.

Current Situation

There is continued interest in mineral exploration in the Keewatin area. The following is an abstract of a 1984 report:

Mineral Exploration Keewatin District

Precious Metals:

Canadian Nickel Company Ltd., had two 4 to 6 person crews investigate the gold potential of the Archean greenstone belt along the coast of Hudson Bay south of Rankin Inlet. One crew drilled 771 m in 17 holes to test the extent and gold content of an exhalite zone in volcanics on Pork Peninsula. The second crew mapped, prospected, sampled and geophysically surveyed gossans and iron-formation on their newly acquired prospecting permits north of Wilson Bay and west of Mistake Bay.

A small crew prospected and did geophysical surveys on a gold showing within the prospecting permit and claims held by M. Magrum west of Maguse Lake.

A 30 person Cullaton Lake Gold Mines Ltd., crew carried out geophysical surveys, geological surveys and reverse circulation overburden drilling on claims adjacent to the producing mine at Cullaton Lake. Members of this crew also prospected newly acquired permits north of Ameto Lake.

Suncor Inc., was also active in the Cullaton Lake area. A 15 to 20 person crew mapped and geophysically surveyed claims and prospecting permits to the east and west of the Cullaton Lake Gold Mines Ltd. properties. Diamond drilling totalling 1,000 to 2,000 m tested anomalies and showings outlined during the ground surveys.

Aberford Resources Ltd. had a 5 person crew prospect, map and geophysically survey a gold showing in Archean volcanics northwest of Imikula Lake.

Uranium

A 6 to 8 person crew from Noranda Exploration Company Ltd.

diamond drilled 700 m on conductors in the Shane Lake area southeast of Baker Lake.

Urangesellschaft Canada Ltd., had some 50 persons exploring their claims west and northwest of Baker Lake. An 8 person crew at Long Lake prospected, mapped and did ground geophysical and geochemical surveys on previously detected anomalies to define targets for drilling. A 20 person crew at Lone Gull did similar surveys to the east and west of the main Lone Gull grid.

A fourth crew of 8 persons were engaged in prospecting, mapping, geochemical and geophysical surveying to outline the source of uranium-bearing boulders at the Lake.

An 8-person PNC Exploration (Canada) Company Ltd., crew explored claims in the Marjorie Lake area.

Westmin Resources Ltd. had a 10 to 12 person crew at Itza Lake.

At the optimistic end of the scale, potential of the belt for base metal and gold has been compared to the Abitibi belt of Ontario and Quebec, the most productive green stone belt in the world. Conservative estimates and the discoveries made to date do not support such a comparison.

CONCLUSIONS

Significant levels of exploration actively are continuing in both the Central Keewatin area and in the Ennadai-Rankin greenstone belt. In recent times, there have been two producing mines in the latter region, a nickel mine at Rankin Inlet and a gold mine at Cullaton Lake. High transportation costs were a factor in suspending operations at the latter

property. There is also very considerable interest in the deposits in the Baker Lake area.

Given the geology of the area, there is a reasonable probability that a production decision for one or more mines may materialize during the next decade. This would be true particularly if the current depressed mineral prices were to rise.

The experience of Cullaton Lake, however, shows that Thompson, Manitoba rather than Churchill is the major mining service and employment center for the Keewatin area and that the Churchill role is that of a transshipment center. The key to an expanded role for Churchill is the development of a resupply infrastructure that is competitive in terms of costs with more southerly centers.